THE

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## ELECTRICAL REVIEW.

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THE ELECTRICAL REVIEW.

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**(J. A. BERLY'S).**

# 1911 EDITION

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## THE INTERNATIONAL CONGRESS OF APPLIED ELECTRICITY.

THE Turin meeting of this Congress will be notable for very many years. At this, its second meeting, the Congress wisely and unanimously took steps to secure a true instead of a quasi-international basis for its future work, by voluntarily placing its destinies under the control of the International Electrotechnical Committee. That Committee will decide when and where the Congress shall hold its future meetings, and will entrust to the electrical institutions of the country selected the carrying out of the detail work. Everyone must see the wisdom of this step. The Congress has been saved from becoming a partially international electrical equivalent of the British Association, at whose meetings local delegates are always numerous. The Congress has already almost as many sections as the British Association, and has what the British Association has not, namely, linguistic difficulties. The official language of the Congress was French, in which all discussions were supposed to have been, but were not universally conducted. Papers were, however, printed, and occasionally read in German, Italian and English. The Congress fortunately was financially able to issue all papers in full, instead of in abstract as at the British Assocation. Of these we shall make a selection and print brief abstracts in our columns, for some are of considerable value. Membership of the Congress, in which the English element is at present distinctly weak, is commended to the consideration of our readers.

The future of the Congress has been secured; fostered by the International Electrotechnical Committee, its meetings will be of world-wide importance, and yet will in no way detract from the value of, say, our own I.E.E. meetings. No better means could have been conceived. In the I.E.C. we have the supreme administrative authority in regard to electrical matters throughout the world. The official representatives of various civilised countries lay down exact definitions of units, and can standardise nomenclature, symbols and the rating of plant. This administrative body is large enough for its duties. If it were larger, the expansion would be at the expense of its efficiency. Too large a body will talk too much and do too little, very much according to the old adage that councils of war never fight.

The Congress, as a subordinate body, meeting possibly at more frequent intervals than the Committee, will provide what our national engineering institutions — British, American or German, as the case may be—do not provide, and that is an international discussion on matters of engineering policy and detail.

But to secure this in the most effective manner, there should be some departure from the policy pursued in Turin. If papers of unequal merit are only issued immediately before the meeting, and if at one session several are down

for discussion, some must get slaughtered, and not always those of least value. Then, again, it is not always edifying when one goes to the marble portals on the Embankment to hear an author read his paper *in extenso*. It is still less so when that paper is read at high speed at an international gathering in a tongue inevitably alien to many delegates. The advance circulation of the paper in any one of, say, four languages, and the reading by the author of an official abstract of, say, 1,200 words in French, would evoke better discussions and improve both the efficiency and the attractiveness of such a congress.

We have written at this length, because the coming of the Congress to London becomes sooner or later a matter of certainty. We should like to suggest that there should be a splitting of the difference between, say, an annual and a quinquennial congress. Triennial assemblies would probably meet the case. If too frequent they will become of local rather than of international interest. While the college professor's long vacation permits of his attending annually, the professional man or the manufacturer will either ignore the Congress altogether, or at best will pay his subscription in order to receive the publications, but will not attend the Congress. The next Congress will meet at San Francisco in 1915.

We may, in conclusion, refer to the meetings of the Congress as revealing the potentialities of modern Italy. Strange, indeed, is the kaleidoscope of history. From republican and imperial Rome spread out a civilisation ranging from the Atlantic to the Euphrates, whose monuments remain in roads and towns, and whose spirit is enshrined in that Roman law which is the basis of so much in our legal systems. Then the tide of conquest rolled inwards, as told in Gibbon's dreary pages. Next came the artistic and literary renaissance, Italian in conception and development, which crowned the end of the middle ages. Turin revealed to those of us who were there last week yet another renaissance in Italy; a renaissance of scientific industrialism. The most recent mechanical manufactures have attained to great prominence; the automobile factory, the foundry, the shipyard, all indicate a high development. The use of electricity for lighting and traction, the employment of water power, the miles of overhead transmission (occasionally on poles and insulators that the Board of Trade would not pass), all portray a wonderful mental receptivity. We welcome it gladly because of our national associations with the political growth of modern Italy, with which British sympathies have been so intimate. But writing in a narrower technical sense as British electrical engineers, we regret that we cannot claim to have had anything to do with the direct inspiration of this electrical development. It is primarily to Switzerland, and in a lesser degree to France and Germany, that Italy is indebted for this inspiration. The British display at the International Exhibition at Turin, with which we shall deal next week, suggests the reason.

**The Apathy of the Supply Authorities.**

Where are the supply authorities? Why are they not buying tickets for Olympia? The Exhibition Committee, the management, exhibitors, and we of the Press may cut ourselves with knives and shout, but Baal either will not, or cannot, hear. Peradventure he sleepeth, or is on a journey into the sales department, or is still away on holiday—but from whatsoever cause, it is now becoming notorious that those who ought to be doing much to help are in danger of making a huge exhibition of apathy and inactivity. The Executive were criticised a few weeks ago for what it was thought they had not done, but the cap at the moment is exactly fitted to another pate. For the 1905 and 1908 Exhibitions, tens of thousands of tickets were purchased by the supply authorities and distributed to the manufacturers and householders in their various areas. On the present occasion very little interest indeed has been shown. Every supply authority stands to gain by widening the people's knowledge of electricity. Then why do they not shoulder their share of this responsibility? For £20 or £30 they can do a great deal of good among the wavering public in their areas by securing their attendance at the Exhibition. Manufacturers have been spending many hundreds, and, in some cases, thousands of pounds to secure an effective representation, but their efforts, as well as those of the Committee, will be rendered to some extent unfruitful unless there be more earnest co-operation or support on the part of those to whom this leaderette is particularly addressed. Wake up, borough electrical engineers! Wake up, Committeemen! Wake up, electric supply companies! Not only are you letting a grand chance slip through your fingers—a better chance altogether than your seven-day local show could ever be—but the responsibility for failure to secure the right people there will lie at your door. The daily Press is writing attractively about the event, the Committee is spending large sums upon advertising, the gas tiger is alert and athirst for the consumer's blood, and you—where are you?

**Central Station Power Load.**

It has been related that a small boy once bestowed his sympathetic attention on a navvy who was wielding a pick in a public thoroughfare (presumably exploring for a live electric cable) and noticed that upon every stroke the navvy emitted a grunt. Being moved by altruistic motives, and being desirous of assisting the navvy in his labours, the small boy suggested to the labourer that if the latter would confine his attention to the pick work, he (the small boy) would do the grunting for him. It was stated that he was very much pained at the way in which the suggestion was received.

Apart from the human interest of the story, it rather suggests the attitude which the central station engineer has in the past adopted towards the business-getting propaganda which has from time to time been suggested. He appeared to think that the mains staff or the chief engineer would have to do all the hard work, while the publicity man (under whatever fancy title he might appear) would simply do the grunting. Happily that attitude is being discounted by practical experience among the electricity undertakings which have adopted progressive business-getting methods, and to-day the consumers' department is a recognised factor in electricity supply. The Exhibition at Olympia ought to be utilised for the obtaining of new business almost, if not quite, as much by the business representatives of electricity supply undertakings as by the manufacturers who are exhibiting.

Finality has not, however, yet been reached by the majority of electricity supply authorities in the organisation of their business-getting departments as regards power business. This is admittedly a more difficult class of business to obtain than lighting, inasmuch as while there is no greater variation in the conditions under which electricity is to be applied in power work, as compared with lighting, a dozen or a hundred similar lighting installations can be found on a supply system for every two similar power jobs. In other words, there is more difficulty in standardising a power proposal than one for lighting. For this reason emphasis needs to be laid on the importance of systematic prospecting and bureau work in power business. By prospecting is meant the careful estimation, based on examination, of the power needs of every likely works in the sphere of supply of an undertaking,

with a view to suggesting a clean-cut proposal for the supply of electricity either at once or at a later date. Some manufacturers, of course, object to an outside engineer of any description examining their equipment in detail; but such types of short-sightedness are, fortunately, rare. The majority of manufacturers are prepared to give facilities to reputable persons to examine their plant, if they think that such persons will thereby be put into a position to make suggestions for reducing the operating costs, such suggestions costing the manufacturer nothing. It may be argued that such prospecting work on the part of electricity supply authorities involves the expense of a technical engineer without the absolute guarantee of business resulting from his work. The best reply to this is that those undertakings which have adopted the method have found it pay. It is analogous to the policy of German chemical manufacturers who keep staffs of highly-trained experts for the sole object of research work. If they are successful the firm benefits hugely; if they are not, the firm does not dock their salaries. Another objection which has been raised is that this policy cuts into the business of the consulting engineer. It is a pity that this is so, if it be so, but it must be remembered that consultants are, after all, but one means of facilitating good business, and if another method pays better, the wheels of progress must not be spragged.

Behind this position, however, lies another, which was also mentioned above. This is the establishment of an information file or bureau in every electricity supply authority's office which will contain actual working data regarding the relation of electric power supply to the industries which occur in the areas supplied. Such a file must not be composed solely of clippings from technical papers. Often these are very useful, and contain valuable data, but a man must be an omnivorous reader to be able to collate from general articles just the precise and intimate information which is necessary for the peculiar problems with which he is faced. The best data are those collected from previous practical installation experience, and for this reason, data of every motor on the supply, the nature of the work it does, together with particulars of its horse-power, type, speed, method of connection to the machine it drives, nature of overloads to which it is subjected, and general performance, should be collected as far as ever possible, and systematically filed. It sounds an appalling task, but it is the keynote to standardisation, and without this no electricity supply system can hope to present an absolutely definite case to the consumer. Failing this, the supply authority is compelled to delegate its technical work to the manufacturing companies which have built up such data systems, and this leads inevitably either to the preference being given, consciously or unconsciously, to one firm, or to the evils of multiple estimating and tendering, which is one of the biggest curses of the electrical industry in existence at the present day.

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**Pacific Cable Act.**

The Parliamentary Paper (274) recently issued from the Treasury Chambers brings this subject again before us.

It has been generally thought that the Pacific Cable is not a paying concern, and this we have from time to time suggested is probably due to the placing to reserve of more than would be placed by a private undertaking. In the accounts before us for the period ended March 31st, the revenue is shown to be increasing, and the general conditions of working have been greatly improved.

When power has been obtained to enable the Board to have a direct cable between Australia and New Zealand, another £14,000 of expected additional revenue will have to be taken into account, and this figure may, no doubt, be regarded as a very conservative estimate.

The position of the undertaking to-day shows that eight annuities of £77,544 have been set aside, equalling £620,352. There has also been placed to the credit of renewal, repair and general reserve a sum of £264,395.

There is evidently a misprint in Statement VI, and securities purchased as *per contra* should read £50,380 instead of £5,038). The Government subsidies have, as we forecasted, gradually decreased from £87,751 in 1903-4, to £48,210 in 1910-11, and so the proportions due from the participants are becoming of a light nature, considering the great advantages to the Empire of a national cable system and the great saving in telegraphic charges to all concerned. A Bill to extend the Pacific Cable Act of 1901 provides that the sums standing to the credit of the reserve fund shall not at any time be less than £100,000; it is proposed to lay a cable from Australia to New Zealand, and the cost will have to be added to the already large capital outlay of £2,000,000, redeemable now in 42 years. Any sums expended for the new cable must be repaid to the "Cable Repair, Reserve and General Renewal Fund" within 35 years at 3½ per cent. interest.

This seems at first sight to be an arrangement which does not possess much elasticity. If the amount be paid out of profit for extending lines, all that is necessary is again to build up the fund from which it has been taken; but why lay down a hard and fast rule as to the period in which the money is to be repaid, and why pay oneself interest?

Then, again, the repaying of capital (large or small) would always depend upon the work an enterprise found before it. That is to say, it would be paid off out of profit and interest saved year by year. It seems cumbersome and expensive to build up a fund to meet the whole of the capital, and pay interest on it for 50 years. Also the extension and duplication of the cables should be provided for, so that the earning power can be kept continuous.

It seems impossible to earmark and hypothecate earnings if full progress is looked for. The Pacific cable will not have the fullest chance, if legitimate extensions in or out of the Pacific are not made, and if duplications are not undertaken before the first line becomes weak and requires all the money set aside to keep it in working order.

The subject of deferred telegrams has been discussed in telegraph circles for many years. It has been left to the Postmaster-General to bring it into greater prominence, and we now learn from this Parliamentary paper that within the next few months there is every prospect of its fulfilment.

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**Scientific Development.**

One of the most interesting and hopeful features of modern industrial practice is the growing tendency to adopt scientific methods of investigation, to hasten the development of new processes or the perfecting of new devices. Conspicuous examples of successful results from the application of scientific method are not far to seek; the tantalum and tungsten lamps, high-speed steel, loaded telephone cables and many other instances might readily be cited, and manufacturers—particularly our German cousins—have learnt that progress may be accomplished in the course of a few months, under the direction of scientific experts supplied with adequate facilities, financial and otherwise, for the purpose in hand, that would require years for evolution by the old-fashioned methods of trial and error.

This being admitted, how is it that we do not see the system more generally put in force? One of the most crying needs of the moment is improvement in the design and construction of electrical cooking apparatus, but, so far as we know, no broad investigation into the principles involved, and the best means of applying them, has yet been undertaken. The Institution of Mechanical Engineers has set a good example by appointing Committees to carry out researches in connection with internal combustion engines, alloys, &c.; our own Institution has set on foot investigations connected with insulating materials, the heating of wires, and so on. Is it beneath the dignity of the I.E.E. to appoint a Committee of research on cooking apparatus?

We commend the matter, with all seriousness, to the attention of the authorities concerned; and in the meantime, for our part, we print in this issue an article on the application of electricity to cooking ovens, which we hope will prove useful to those engaged in the design of such apparatus.

## THE APPLICATION OF ELECTRICITY TO COOKING OVENS.

[CONTRIBUTED.]

Now that electricity for cooking purposes appears as if it were, before many years have passed, to be used on a scale comparable with gas, it may be of interest to consider some of the factors in the problem presented to ironfounder and electrical engineer. The subject has already received consideration from a number of firms equipped for the work, and a variety of electrical cooking appliances is on the market at the present time. Costs of operating the various apparatus are also available in many instances, details having been published in back numbers of the ELECTRICAL REVIEW. It is not the intention of the writer of this article, however, to give specific figures relating to present design or performance; but rather the desire is to direct attention to the general principles underlying the design. Further, only one of the many possible applications of electricity to cooking is here considered; and it must be understood that none of the remarks need necessarily apply to modes of heating or cooking other than that with which we are immediately concerned —viz., the application of electricity to ovens.

It may be as well to state right away an assumption made all through the article—one, possibly, which will be readily enough admitted—viz., that in general oven-cooking the ideal condition is one in which the object to be cooked is subjected to a sensibly equal temperature at all points. It may be that for particular operations, special distribution of temperature is required; but particular cases may be approached with more confidence when the general case is understood.

The present design of electric oven has followed that of the gas oven in many essential points, except that in the latter the bottom of the oven is usually open, while in the former the oven is completely closed. Both types usually consist of an oven proper in an outside casing, the space between the two shells being filled with some bad conductor of heat. The transition from gas practice has not been altogether satisfactory to the electric oven, which still labours under several disadvantages because of an insufficient appreciation of certain fundamental differences in the two problems.

The first step in the design of an oven is obviously the complete consideration of the characteristics of the heat-producing medium, whether it be coal, coal-gas or electricity. A comparison of the costs of obtaining heat from these sources is both instructive and interesting, and shows very clearly the initial difficulty that electricity must face. If coal of a lower calorific value of 10,500 B.TH.U. per lb. can be obtained at 17s. per ton; if gas of a lower calorific value of 550 B.TH.U. per cb. foot can be obtained at 2s. 6d. per 1,000 cb. ft.; and if electricity can be obtained at 1d. per B.T.U.; it can easily be calculated that for 1d. the numbers of units of crude heat to be obtained from coal, gas and electricity are approximately 115,300; 18,300; and 3,410 respectively. From this it appears that it costs $5\frac{1}{3}$ times as much to get any given amount of heat from gas as from coal; and 34 times as much to get the same amount of heat from electricity as from coal. Heat from coal is, therefore, so cheap comparatively that few precautions are taken to utilise the total available thermal units to the best advantage. Improvements in the design of coal-fired ovens are, however, being introduced from time to time, and there is reason to believe that, as the price of coal increases, greater attention will be paid to this matter in order to reduce the cost of operation. Similar remarks apply to the case of gas; for, though various precautions are certainly taken in gas ovens of repute to minimise waste of gas, the limit of efficiency is not yet reached. It will be evident, of course, that while it may not be easy greatly to improve coal-fired ovens in respect of heat utilisation, it is not so difficult to accomplish this with the gas oven; and the actual efficiency of the average gas oven is considerably above that of the average coal-fired oven. With electricity, on the other hand, the problem of how to save heat is very much simpler than in the other two cases; and efficiencies very much higher than those of the best gas ovens are readily obtained. Indeed, it is because of these higher heating efficiencies that it is possible for the cost of electric cooking to approach the cost of cooking by gas or by coal.

In an electric oven of present design, the heat energy is absorbed in five principal ways, being required:—

1. To raise and maintain the temperature of the heating element.
2. To raise and maintain the temperature of the air enclosed in the oven.
3. To raise and maintain the temperature of the internal metal work of the oven.
4. To make good the heat lost by radiation and convection, &c.
5. To cook the food.

Headings 1 to 4 represent losses, of which 1, 2 and 3 are quite unavoidable, being inherent in the system of transmitting heat from the electric current to the food to be cooked.

Under heading 4, losses which are to some extent avoidable are included, but it is to be understood that part of these losses also are unavoidable.

1. The percentage of the total amount of heat used in the cooking process that is required to raise the temperature of the element itself is in general quite negligible, and may safely be ignored so far as any of the present-day elements are concerned. The actual amount of heat necessary may be calculated with fair accuracy when the physical properties of the element are known; as a rule the amount is by far the smallest of the losses represented by headings 1, 2, 3 and 4. There seems to be a tendency to cut down the weight of the element—and also its size—to a minimum; it size may or may not be of much importance, but certainly its weight is of little or no importance within fairly wide limits; and there is little need to endeavour to save an ounce or two in the weight of the element at the expense of its reliability and useful life.

2. The proportion of heat required to raise and maintain the temperature of the air inside the oven would not be very considerable but for the facts that (*a*) the food absorbs the heat it requires mainly from the air, and (*b*) there are always leakages of air from the oven. With regard to the latter, heat is lost when the oven door is opened for any purpose, and perhaps the usual ventilator and leaky joints add considerably to the total loss under this head. The remedy in this case is to have the oven joints as tight as practicable, and to open the oven door no oftener than is essential.

3. With regard to the heat required to raise the temperature of the internal metal work of the oven, this probably ranks next to 1, in ascending order of magnitude, in the ordinary daily use, since the oven is likely to be in service some hours at a time; the total amount of heat accounted for under this heading will in usual cases be about 6 or 7 per cent. of the whole. The weight of the metal of the oven and of the shelves, &c., inside the oven, and their specific heat determine the actual amount; therefore it is obvious that it is advisable to cut down the weight of these parts as far as possible consistent with their having sufficient strength. It is to be understood that this remark refers only to the interior oven or oven proper; the thickness of the outside casing and its weight have no direct connection with the amount of heat required to raise the temperature of the interior oven.

The heat required under heads 1, 2 and 3 may be regarded as heat stored in the oven which will be given out again when the oven cools down; and if it were practicable to work on such lines, the heat losses might be decreased. In the ordinary case, such a procedure would be ridiculous; and though some use can certainly be made of the heat stored in the oven, it is much safer to assume that it is totally lost.

4. The heat lost by radiation, convection, &c., forms the largest percentage of the total heat lost, and here it is possible to effect fairly considerable economies. For convenience' sake, this loss will be referred to as a radiation loss, the term being quite sufficiently accurate for our present purpose. The general features of the problem of radiation are well known, and, as they affect the case of electric ovens, may be shortly stated thus:—

(*a*) The rate of heat loss increases rapidly with rise of temperature.

(*b*) The rate of heat loss decreases with greater efficiency of heat insulation.

(*c*) The heat loss varies with the area of the surface exposed.

The surface of the oven is fixed by consideration of utility and size, and will be taken as unalterable; the ratio of oven surface to oven volume increases, of course, with decrease in the size of oven. With regard to (*a*), however, the lower the temperature of the oven, the less the radiation losses; therefore, no higher an oven temperature should be used than is sufficient for cooking purposes. According to modern cookery practice, the highest oven temperature generally required is 380° F. to 400° F. The heating elements themselves are naturally at a higher temperature than this, and the radiation losses in their vicinity are considerably greater than in positions further remote from them. Care should be taken to see that the lagging of the oven near the elements is quite satisfactory, as well as to see that the elements are run at as low a temperature as possible.

Various opinions have been expressed from time to time regarding the heat insulation of an electric oven, see (*b*). For very small ovens to be used for short times only, quite a good arrangement is to have the oven of thin material very brightly polished outside and inside. The effect of the bright inside surfaces is to reflect some of the heat back into the oven and of the outside surfaces to hinder the radiation of heat from the oven. Such a design is open to the criticism that no precaution is taken to prevent currents of air carrying off large amounts of heat by convection; but, as already indicated, for very small ovens in use for short periods, it has the advantage of initial cheapness, and its efficiency is not abnormally low under ordinary conditions.

For ovens of larger size some other means of preventing large radiation losses must be adopted, as experiment clearly shows the above simple design to be very inferior from this point of view; and up to the present nothing better has been devised, for commercial purposes, than to suspend or fix the oven proper inside a stout outer casing, and to fill the space between them with asbestos, slag-wool or other bad conductor of heat. The thickness of this insulation should be as great as possible—considerations of first cost will place a limit on the thickness adopted rather than considerations of maximum economy—the minimum being about 2 in. Whatever the thickness employed, the lagging should be packed fairly tightly between the oven and its casing, to prevent access of currents of air which would carry off heat by convection. Care must also be taken to provide the minimum of metallic connection between the oven and the casing (not more than is made by a few screws, as the oven may rest on blocks of heat-insulating material). This is a point which is too often overlooked, and it is really surprising to find ovens in which a considerable amount of lagging is used with metallic contacts, which quickly render the lagging of little effect, to the detriment of the oven's efficiency.

5. It is hardly necessary to deal with the heat utilised under this heading, as the subject has nothing to do with the manufacturer. It has been pointed out that we assume that the food to be cooked obtains the necessary heat from the surrounding air, which should be at nearly uniform temperature throughout the oven. If the food is exposed to "radiant heat" from the elements, it will be found very difficult to obtain a uniform temperature in the oven; and as "radiant heat" has no place in successful coal-fire and gas ovens, there is no apparent reason why it should be recommended in an electric oven, while there is a good reason, above stated, why it is a drawback. For grilling, toasting, &c., radiant heat is of immense value, but to apply it to oven heating in general would seem a mistake.

Turning now to the heating element, it will be admitted that its nature is of no moment so far as the conversion of electrical energy into heat is concerned. A given number of Board of Trade units will generate the same amount of heat whether the medium be wire, of high or low resistance, or any special form of element. The actual relation is approximately—

1 B.T.U. = 3,410 British Thermal Units.

There are, however, conditions other than the above which greatly reduce the number of possible and practicable types of elements, or resistance; and some of these conditions will now be considered briefly.

First of all, the element must not melt at the highest temperature it can attain in the oven under full power. The resistance may stand the current quite successfully in the open air, but the hot oven obviously makes a vast difference. Nor should the element in general be very near its melting point, as a certain amount of mechanical strength is usually required, and this can scarcely be sufficiently obtained if the material is near its fusing point. It is advisable that it should have a low temperature coefficient in order to prevent the passage of unduly heavy currents when the power is switched on with the resistance cold. It is also very important that the action of the air on the element, as a whole, is negligible, *i.e.*, the element must not oxidise rapidly, if it oxidises at all, even at the highest temperature to which it can be exposed in the ordinary use of the oven.

Trouble may be experienced with the expansion and contraction of certain classes of elements, and this must be guarded against. The design of the necessary fixings should permit of the movement taking place without throwing on the element stresses above those which it can safely bear.

Consideration ought to be given in some measure to the question of ease of repair; and such an arrangement should be adopted as will not necessitate shutting down the whole oven because of the failure of a section of the element; the more so, since repairs will usually be done by ordinary workmen, not specially skilled in this particular branch.

The element must be able to resist the effects of the hot juices and vapours met with in the oven, and should not be damaged if liquids are spilled on it.

It is extremely difficult to comply with all the above conditions in the commercial electric oven and, as in many engineering problems, a compromise may be adopted. In the meantime, it would appear that wire elements, as a class, most nearly fulfil all the conditions, their one real drawback being their liability to oxidation at high temperature. It may be anticipated, however, that this disadvantage will be largely overcome in due time; possibly by the discovery of a new material, possibly by the better use of the material to hand at the moment. In certain cases, however, it would seem that this problem of oxidation—closely allied to that of the melting point in some ways—is not being tackled in a rational fashion. Since oxidation takes place most rapidly at the highest temperatures, the aim should be to keep down the temperature of the wire to the lowest necessary to give the required oven temperature in a reasonable time. The heat may be transferred from the element (*a*) by a small area of high temperature; (*b*) by a larger area of lower temperature, and obviously in this connection the larger area is to be desired. From the point of view of radiation also, the larger area of heating surface is an advantage, always provided that its temperature is kept correspondingly low. In order that such an element may not require too much space in the oven, its volume must be kept down by making it as thin as practicable.

Trouble is experienced in large ovens in keeping the inside temperature sensibly uniform, but this may be largely got over by the insertion of thin sheet metal baffle plates so fixed as to give a definite direction to the currents of air. The larger the heating surface, of course, the less the need for such a device.

The choice of position of the elements comes up here. So far as actual heating efficiency is concerned, there is probably not a great deal to be said against any of the usual positions, provided the element is contained wholly in the interior oven. It may be, however, that positions at the sides of the oven are conducive to a better circulation of air than are top and bottom arrangements. As the elements must also be protected from meat juices, the side position offers some advantage, as sufficient cover is obtained by a louvred thin sheet metal plate having its openings downwards. In the case of bottom elements a cover, which will allow of free passage of the air and yet prevent grease, &c., getting into the element is not quite so simple, though a similar arrangement can be devised.

The placing of an element of large heating surface at

the side of the oven will generally require a design of inside racks different to that usually adopted; but there is no difficulty in providing quite a suitable arrangement. There should be an air space between the back of the element and the side of the oven if the best results are to be obtained, and the element should be inside the oven entirely, and not relegated to a special compartment. Such a design destroys the primary idea of a good circulation of hot air.

The element should be so constructed as to enable its removal from the oven to be accomplished with comparative ease, connections being simply yet securely made. The electrical insulation of wires from the metal work of the oven, and of one section of the element from another, requires a little care, and must not be overlooked.

The power consumption for which any oven is designed will depend primarily on the use to which the oven is to be put. But it will also depend on the efficiency of the lagging and, to a lesser extent, on the cost of energy. Nothing need be said on the first two points; but the third is not evident at first sight. The fact is that, if the cost of energy is low, a liberal allowance will be advantageous in some respects; if it is high, a smaller current will probably prove the more economical in the long run. The explanation is that with the systems of control in general use, it is more difficult to strike the exact temperature required with the heavier current than with the smaller current, and in many cases there is a temptation to keep on the full power longer than is necessary. This tends to heavier running costs with the large currents, which, if energy is cheap, may be neglected altogether; but there is the undoubted advantage of being able to reach any desired temperature of oven in a shorter time with the heavier current.

Generally, full power should be sufficient to raise the temperature of the oven from that of the surrounding air to about 400° F. in, say, 30 minutes. Higher consumption of power will decrease the time required to attain the same temperature, and *vice versa*; but as the time taken decreases in a greater ratio than the power increases, it is obviously more economical, so far as heating up the oven is concerned, to use the larger power. For instance, in a certain oven, full power heated the oven to a temperature of 400° F. in 18 minutes, whereas half power took 50 minutes to do the same—a comparison very evidently in favour of the faster heating. The reason for this is that the quicker an oven is heated up, the less time there is for radiation losses and the greater the efficiency of the apparatus as a whole.

This, however, is only one point in the problem, and the disadvantages of high powers, already explained, more than counterbalance this advantage. An oven of average size will have ample power—provided the lagging and the position of the element are attended to properly—if its allowance is from 0·5 to 0·6 KW. per cb. ft. of oven capacity. In specially designed small ovens, less than this allowance is met with, and in large ovens as much as 1·2 KW. per cb. ft. is recorded.

With regard to the control of the oven, that most satisfactory from the technical point of view is one which will permit of any desired temperature being attained and maintained without variation. Such a perfect arrangement would probably be useless in ordinary circumstances, and a simpler method must be adopted. A consideration of the conditions leads to the conclusion that, at the very most, four different "heats" are advisable, and, at the very least, two different heats are essential; the greatest power is used only to heat up the oven, and the lower powers for the various cooking operations. If four heats are favoured they can be easily arranged for, by having the elements in four sections, in parallel; or in two sections in parallel, each section consisting of two parts in series, each part being controlled by a separate switch. Such a method of control lends itself nicely to obtaining a symmetrical arrangement of half power heating, which, as a rule, is sufficient for roasting purposes during the greater part of the process.

If two heats are regarded as sufficient, a satisfactory arrangement is to have the elements in four parts also, and to control one part of the element on one side in series with a second part on the other side, by one switch. This method also gives a symmetrical distribution of heat.

The simplest method of two-heat control is, of course, to have two switches, each controlling its own element.

There is need to add that the necessary switches ought to be designed with some regard to the currents in the circuits. Manufacturers are too apt to supply a very flimsy article, which may be positively dangerous, when the conditions call for something considerably more substantial; in this, however, the makers are probably no worse than are others in different trades.

There is no doubt that a reliable thermometer registering with reasonable accuracy the temperature of the oven is of great assistance in the economical working of electric ovens. But if sufficient information regarding the various heats, and the purposes for which each heat is most useful, is supplied with each oven, the thermometer may be omitted from the outfit without serious loss.

Not much has been said above on the subject of opening the oven door; this is generally supposed to be a very great source of waste indeed. No doubt a considerable amount of heat may be lost in this way; but as authorities are agreed that, for example, "basting" of joints is essential at regular and frequent intervals, there seems nothing for it but to open the oven door as often as may be necessary. Perhaps if someone invented a satisfactory mechanical apparatus for basting, this source of loss might also be eliminated to a great extent.

## NOTES ON TENDER FACTS AND POLICIES.

By L. CROUCH.

From time to time the writer has prepared various analyses of the amounts of published tenders for electrical contracts, and he now commends to the attention of his readers the following notes based on these investigations:—

There is naturally considerable variation between the highest and lowest tenders for any particular contract, which variation is usually proportionately greater on small than on large contracts. The truth of the latter statement is evidenced by Table I, in which the percentage excess of the highest over the lowest tender in contracts of various average amounts is shown as a mean function of the latter. These figures also show the highest tender to average a value 20 per cent.—50 per cent. (or even 70 per cent.; grand average from Table I = 50 per cent.) above the lowest tender received.

It goes without saying that the lowest *bonâ fide* tender received is usually the one accepted, but the indiscriminate issue of contracts to the lowest tenderer is extremely unwise. A reasonable margin between the lowest and accepted tenders should be permitted when such will enable the tender of an experienced firm of high repute to be accepted, in preference to the lower estimate of a less reliable contractor. Much engineering material and machinery cannot be thoroughly judged till it has been in use for some time, so that a purchaser is forced to rely, to a certain extent, on the honesty and experience of the contractor, and it is quite reasonable to allocate a certain capital value to these attributes. Firms seeking new lines of development will frequently send in very low tenders for the sake of gaining experience in the work concerned; the

TABLE I.—Excess of Highest over Lowest Tender in 160 Electrical Contracts (Years 1909-11).

| Average value of contract. | No. cases considered. | Percentage excess highest over lowest. | | |
|---|---|---|---|---|
| | | Maximum. | Minimum. | Average. |
| £0—100 | 24 | 233 | 2 | 68·4 |
| £100—250 | 38 | 144 | 2 | 44·5 |
| £250—1,000 | 38 | 150 | 1 | 55·5 |
| £1,000—5,000 | 32 | 194 | 2 | 48·8 |
| £5,000—10,000 | 11 | 182 | 3 | 47·2 |
| £10,000—30,000 | 7 | 40 | 2 | 21·0 |
| £30,000—50,000 | 5 | 90 | 18 | 37·4 |
| over £50,000 | 5 | 52 | 5 | 19·6 |

purchaser may apparently save considerably by accepting this unusually low offer, but it is more than likely that he will ultimately pay dearly for the contractor's inexperience. (This remark applies rather to small contractors than to large firms seeking fresh developments and having a valuable reputation at stake.)

When a firm guarantees to employ British labour at predetermined minimum wages, this fact should be placed to its credit in comparing its tender with those of firms prepared to take all or some of the work out of the country in order to secure cheap foreign labour.

It is interesting to examine, in some detail, how often the lowest tender is actually accepted in this country. Basing the present analyses on the notes on "Tenders Accepted," appearing in the columns of the Electrical Review during 1909-1911, and considering only those contracts concerning electrical materials and apparatus (including complete generating sets), it is found that only the accepted tender is published in a number of cases. In practically every such instance the accepted tender was the lowest received, and it may be noted that the average value of these contracts was only 20-30 per cent. that of the average accepted tender in cases where full particulars were given of all tenders received (see Table II).*

TABLE II.—Contracts for which only Accepted Tender was Published (1909-11).

| Year. | No. of contracts. | Total amount of accepted tenders. | Average value of accepted tender. | Value (%) of accepted tender, as compared with corresponding figure in Table III. |
|---|---|---|---|---|
| 1909 | 131 | £190,938 | £1,457 | 27 per cent. |
| 1910 | 254 | 332,314 | 1,308 | 22 ,, |
| ½-1911 | 106 | 87,585 | 826 | 75 ,, |

Table III summarises the leading particulars of the latter class of tender for the years 1909, 1910, and first six months of 1911. It will be seen that, in from 90-100 per cent. of the total number of cases considered, the lowest tender was accepted. The gross excesses of the accepted, highest and mean tenders respectively over the lowest tenders were :—

| Year. | Accepted. | Highest. | Mean. |
|---|---|---|---|
| 1909 | £410 | £83,609 | £36,467 |
| 1910 | 602 | 116,102 | 40,952 |
| ½—1911 | nil | 11,705 | 8,073 |

—the average values per contract of the various groups being as shown in Table III. The average accepted tender was only 0—½ per cent. higher than the average lowest tender, the excess of the average mean tender being 10—20 per cent. There is thus little actual necessity in practice to decline the lowest tender for any of the above reasons, *if* the tenders here considered were all allocated in the best manner possible—a point which is at least open to question. The importance of the above considerations cannot be disputed, and the fallacy of hastily accepting the lowest tender is gaining ever wider recognition.

TABLE III.—Contracts for which full List of Tenders Received was Available. (1909-1911.)

| Year. | No. of cases. | | Average amount (£) of tender. | | | | *Average number of firms tendering. |
|---|---|---|---|---|---|---|---|
| | Total. | Lowest tender accepted. | Accepted. | Lowest. | Highest | Mean. | |
| 1909 | 70 | 63 | 5,347 | 5,341 | 6,535 | 5,861 | 7·8 |
| 1910 | 69 | 65 | 5,928 | 5,920 | 7,600 | 6,513 | 7·0 |
| ½-1911 | 34 | 34 | 1,107 | 1,107 | 1,451 | 1,344 | 6·2 |

* See text.

The total money paid out on the contracts analysed in Table III (= Σ tenders accepted) = £374,282 in 1909; £409,062 in 1910; and £37,628 during the first six months of 1911. The relatively low total in the latter case is due to the absence of tramway extension contracts, in London and elsewhere, which contributed so greatly to the 1909-10 figures.

It is interesting to note that the average number of firms tendering, in the contracts dealt with by Table III, fell from 7·8 in 1909, to 7·0 in 1910, and 6·2 in 1911 (to June 30th). The cases concerning which incomplete data are available (Table II) would, of course, affect these figures to a limited extent, especially in view of the fact that, among the contracts dealt with in Table II, for which 10 or more firms submitted tenders, the majority relate to small business :—

| In year | No. of cases in which average amount of tenders was— | | | | | | |
|---|---|---|---|---|---|---|---|
| | Less than £100. | £100—£500. | £500—£1,000. | £1,000—£2,000. | £2,500—£5,000. | £5,000—£7,500. | Other cases. |
| 1909 | 2 | 7 | 2 | 4 | 2 | 2 | 10 firms for a £33,465 contract |
| 1910 | 2 | 4 | 1 | 3 | 1 | 1 | 28 for £19,572 |
| ½-1911 | 1 | 2 | 1 | — | 1 | — | 26 for £14,063 |

In other words 55 per cent. of these cases concerned contracts for less than £1,000 each, and 75 per cent. involved less than £2,000 each, *i.e.*, it is for contracts of small amount that the greatest number of firms tender, so that omissions in data concerning relatively unimportant contracts may easily affect the apparent average number of firms tendering. It is quite possible, however, that the decrease in the latter figure during 1909-1911, as shown by Table III, may have a definite industrial significance.

It has been pointed out that a firm may tender at an unprofitable figure for the sake of gaining experience in a new class of work. A somewhat similar case, but one which leads to quite different results so far as the purchaser is cerned, is that of a contractor submitting an unprofitable tender for the sake of securing special advertisement from the gaining of the contract. Several notable instances of this policy have lately arisen in connection with street lighting. Gas companies have undoubtedly offered to light the main streets of certain large cities at unremunerative rates (even below cost price), for the sake of advertisement and to gain prestige in the eyes of prospective gas consumers. It is only fair to remark that certain electric supply authorities have been accused of the same policy—though with much less justification.

In such a case, the lessor of the contract will probably secure the best products and services of the contractor at a more or less exceptionally low figure, and he should generally accept the tender, providing this does not involve unfair hardship to any other party, and providing he does not thereby commit himself to unavoidable further dealings with the same contractor who, at a later date, may take advantage of his position to recoup his previous losses! The contractor regards such an "unprofitable" tender strictly as a commercial proposition; by it he gains the advertisement and prestige he seeks, and, in many cases, he recoups the whole cost thereof from other clients, a number of whom he probably secures as the direct result of the original tender and its favourable terms.

In every class of contract there are a number of cases decided entirely by private interest or patronage, and it is needless to say that, in such instances, the successful tender is accepted by no means obvious or logical to the statistical student! Apart from such irregular transactions (which, though involving a vast annual expenditure, are mainly confined to miscellaneous routine contracts, such as can be passed unobtrusively by the persons concerned, and to minor "special" contracts), a study of published information relating to tender acceptances requires little labour, affords much valuable knowledge, and should certainly be more common among engineers than is at present the case.

* In 1911 (up to June 30th), the absence of very large contracts (see Table III), makes this percentage so high as 75 per cent.; a considerably lower figure will doubtless be attained for the complete year.

**Graetzin Lamps in Euphos Glass.**—We understand that Messrs. Krupka & Jacoby, of 11, Queen Victoria Street, E.C., who have met with a large demand for the Graetzin metallic-filament lamp, are supplying it with bulbs made of Euphos glass, which is specially prepared so as to intercept all ultra-violet rays, and thus protect the eyesight from injury.

## HIGH-VOLTAGE TESTING.

By DANIEL H. OGLEY, B.Eng. Royal Technical, Salford.

A well designed high-voltage testing department should be an essential part of the equipment of all test houses, as almost every machine specification calls for stringent insulation tests. This being so, the ohmmeter test—while affording a certain indication of the insulating qualities of a machine—cannot be taken as final, but requires to be supplemented by a power test.

Besides machine insulation tests, all insulation should be subjected to pressure tests before assembling, the pressure required for this purpose varying from, say, 20,000 volts in the case of mica tubes, to as low as 1,000 volts for thin presspahn and the like.

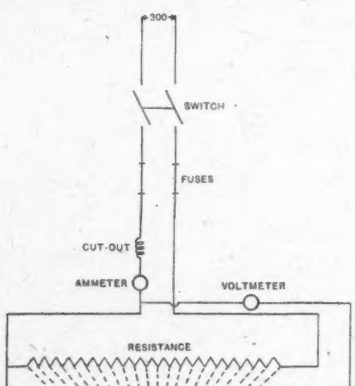
A testing voltage varying between wide limits is thus called for, and may readily be obtained by the installation of the simple apparatus shown in the sketch below.

The instruments, cut-out, &c., could be mounted on a small board fixed above, and at the back of the resistance, which latter would be best wound on porcelain and covered with a perforated frame to assist in ventilation.

A supply voltage of 300 or so in conjunction with an 80 : 1 transformer would give all the variation required, and the voltmeter could be calibrated to read the high-tension volts directly.

The transformer should be fixed in a test bay, which is understood to be devoted entirely to high-pressure tests; and further to remind workers in other parts of the building of the fact, it may be surrounded with a red barrier. The switchboard is fixed at the other end of the bay remote from the transformer, and as all variation of pressure is conducted from the switchboard, danger to assistants is obviated.

Some manufacturers prefer to test the machines where they have been assembled. This is a dangerous practice, since the transformer must either be moved to a position close




Connections of H.V. Testing Apparatus.

to the machine, in which case it is difficult to screen the apparatus being tested from the workmen, or long high-pressure leads must be taken from the test bay to the machine. All workmen must be moved from under the leads, and accidents are very likely to occur. In both cases, the assistant varying the pressure is often out of sight of the apparatus being tested, and has to rely for guidance on shouts from some other assistant on the spot.

It is much better practice to test all apparatus in the high-pressure testing bay, where it is in sight of the tester and is not dangerous to anyone.

*Machine Tests.*—Machine tests are more or less standard, stators being tested with from 2 to 2½ times the working pressure, and the duration of test being one minute. The usual rotor test for voltages between 250 and 500 is 2,000 volts, and 1,000 volts for those below 250 volts, with the exception of squirrel-cage rotors, the testing voltage in this latter case being 250-1,000 volts.

Some recent tests stipulated in specifications are as follows :—

1. Three-phase induction motor, mesh-connected, 6,000 volts alternating supply. Test 12,000 volts for five minutes before and after nine hours' run.

2. 500-volt three-phase star-wound stator. Test 2,000 volts for one minute between winding and earth.

3. 6,600-volt induction motor. Test 17,000 volts for one minute between winding and earth. Rotor (squirrel cage) 1,000 volts for one minute.

4. 2,000-2,500-volt single-phase generator. Test 5,000 volts for five minutes winding to earth.

*Insulation Testing.*—In testing insulation great care should be taken to avoid the forming of corona streamers, as, owing to their intensely localised heating effect, no correct breakdown test can be made when they are permitted to form.

The streamers form with great difficulty when each electrode is surrounded with a dielectric. Thin sheets of presspahn, &c., may be properly tested by making the sheets up in tubes and slipping them over thin metal rods mounted at right angles. Glass tubes may be tested properly in this manner.

Mica tubes may be tested by using an electrode in the form of a flexible wire brush. This is drawn inside the tube and makes contact with the whole inside surface. The outer electrode is a sheet of metal wrapped tightly round the mica tube.

To avoid the formation of corona when testing lead-covered cable, asbestos wool may be applied in a bunch over the ends. The corona is displaced by the slight current which the asbestos carries.

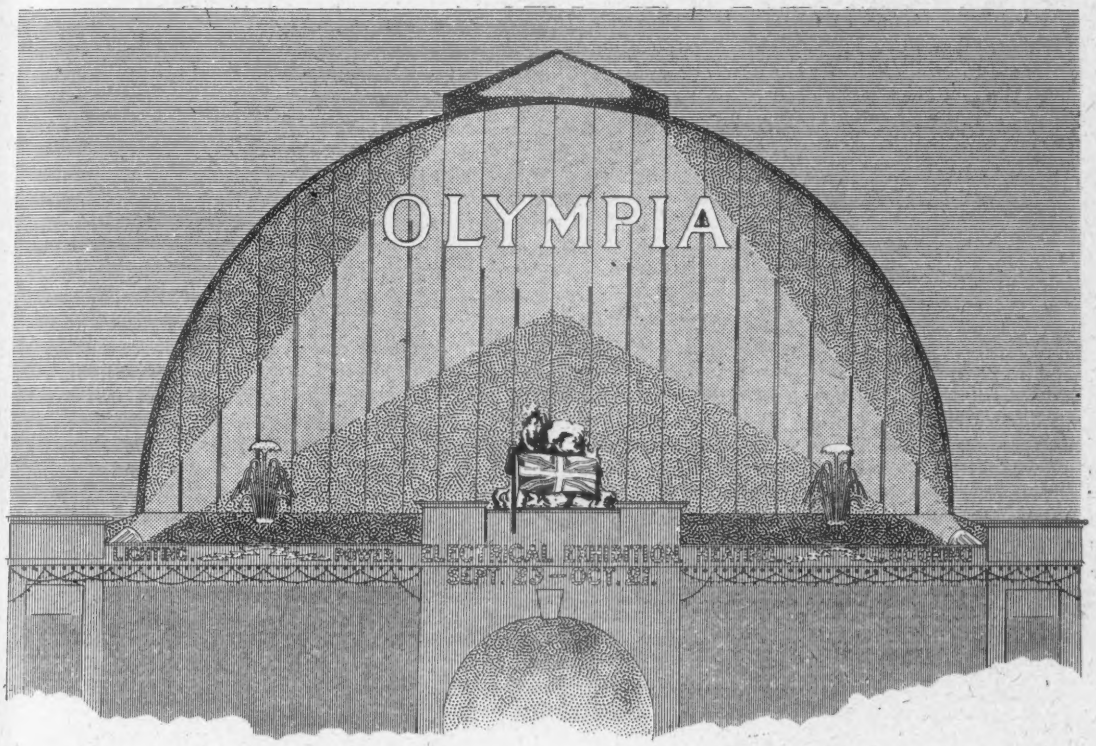
## ELECTRICITY SUPPLY AT OLYMPIA.

The whole of the electricity supply at the forthcoming Electrical Exhibition at Olympia is taken from the Hammersmith Borough generating station, with the exception of such energy as may be used on consumers' own stands, being generated by self-contained exhibition plant. The bulk of the supply is single-phase, 50 cycles A.C., supplied to three permanent sub-stations in the Exhibition buildings through 2,200-volt cables from Hammersmith. These sub-stations are entirely independent (maximum security of supply being thus obtained), and contain 2,200/220-volt static transformers. The possible single-phase supply is approximately 1,260 KW. Three-phase current is obtained, from a high-pressure two-phase supply from Hammersmith, by the Scott T-transformer system (180 KW. available at 220 volts three-phase). Direct-current supply is from three sources :—(*a*) From a temporary 300-KW. sub-station fed with 2,200-volt two-phase current from Hammersmith through cables of 400 KW. capacity. The two-phase supply is transformed to six-phase current, which is fed to a rotary converter delivering at 220 volts D.C. (*b*) From two motor-generators, each of 150 KW. capacity, permanently installed on opposite sides of the Exhibition building. These machines are supplied with 2,200-volt two-phase A.C., and deliver 220-volt D.C.

From the permanent and temporary sub-stations supply is taken to the various stands *via* cables and service-boxes laid in the floor of the Main Hall or attached to girders under the galleries. The greater part of the distributing network is permanently laid in the building, but it has been necessary to employ a considerable length of temporary cable, some of which is of 0·6 sq. in. copper section (480 amperes capacity). All distributing conductors are rated at 800 amperes per sq. in., and an insulation resistance of at least 1,000 megohms per mile is specified. Leads from the service boxes to the consumers' switchboards must be enclosed in screwed iron barrel or wood casing; the use of flexible wiring is dis-

couraged, and all wires within reach of the public are to be enclosed in wood casing or other approved covering. Unencased conductors must not be in contact with bunting or other inflammable material. In the application forms for electricity supply issued by the management to exhibitors, there is a most useful summary of the safety precautions necessary in wiring and illuminating stands.

All the meters, D.P. switches and fuses required up to the stand delivery terminals are provided by Messrs. Ferranti, Ltd., on behalf of the management, but exhibitors must supply all their own lamps, motors and wiring, &c. High-




Electrical Illuminations at Olympia.

pressure cylindrical fuses with tin wires chosen to blow at 50 per cent. overload are specified; metallic-filament lamp circuits must not contain more than 15 lamps, and each lamp therein must not exceed 50 C.P.; motors exceeding ¼ H.P. must be of the enclosed or enclosed-ventilated type.

Four scales of tariffs have been adopted, viz.:—

1. A.C., one-phase, 220 volts, 50 cycles, for illuminating purposes or equivalent small demands—inclusive tariffs (covering terminal and connecting charges, &c.):—

| | | | |
|---|---|---|---|
| 0·28 KW. maximum demand ... | ... | £2 | 2 0 |
| 0·56 „ „ „ ... | ... | 3 | 15 0 |
| 0·84 „ „ „ ... | ... | 5 | 5 0 |

2. A.C. one-phase 220-volt 50 cycles, by meter:—2½d. per unit plus terminal charge.

3. D.C. 220-volt by meter:—3½d. per unit plus terminal charge.

4. A.C. three-phase 220-volt 50 cycles, by meter:—2½d. per unit plus terminal charge, and a charge for hire of distributors from the temporary sub-station.

The terminal charges for tariffs (2), (3) and (4) are:—

| KW. demand. | Terminal charge. | KW. demand. | Terminal charge. |
|---|---|---|---|
| 2 ... ... | £3 3 0 | 8 ... ... | £9 9 0 |
| 3 ... ... | 4 4 0 | 9 ... ... | 10 10 0 |
| 4 ... ... | 5 5 0 | 10 ... ... | 11 0 0 |
| 5 ... ... | 6 6 0 | 15 ... ... | 15 0 0 |
| 6 ... ... | 7 7 0 | 20 or over ... | 20 0 0 |
| 7 ... ... | 8 8 0 | | |

About 250 exhibitors will take electricity supply; approximately 140 will consume ¼ to 1 KW. under tariff (1), but of these a number also require power supply under (2), (3) or (4).

Though the charge for D.C. supply is only 1d. per unit higher than that for A.C., the additional cost to the management is about 1½d. per unit. No attempt has been made to secure more than a safe profit from the sale of energy; the lighting tariff is very favourable, but, owing to the limited supply available, no special concession can be granted to power consumers. A large and steady lighting demand has been encouraged, and, at the discretion of the consulting engineers (Messrs. Russell & Snell), motors taking an excessive starting current may be subjected to limitations as regards time of starting and distribution and duration of running periods. All lighting is confined to the main single-phase supply, except where direct current is essential, as in the case of some arc lamps. The single-phase supply is cheapest and available in greatest bulk, and the security of supply and constancy of voltage are greater than can be guaranteed in the D.C. and three-phase circuits; hence its preference for the lighting supply.

The peak demand will probably occur at about 7 p.m. and remain fairly constant till near closing time. So far as is at present known, the total demand will be roughly as follows:—

| | KW. demand. | Available supply. |
|---|---|---|
| Single-phase A.C.—lighting (tariff (1)) | 95 KW. | 1,260 KW. |
| —power (tariff (2)) ... | 754 KW. | |
| Direct current—(tariff (3)) ... ... | 532 KW. | 600 KW. |
| Three-phase A.C.—(tariff (4)) ... ... | 236 KW. | 180 KW.* |
| Total ... ... | 1,617 KW. | 2,040 KW. |

* Supplemented by temporary sub-station.

The maximum demands yet received are for 341 amperes, single-phase; 182 amperes, D.C.; and 150 amperes, three-phase (220 volts throughout); these currents are the limiting capacities of the maximum-demand meters, and are somewhat above the probable demand, to reduce the risk of damaging the instruments. Among the demands for supply under tariffs (2), (3) and (4), 78½ per cent. are for 40 amperes or under, and 38 per cent. for 10 amperes or under.

Though application forms for electricity supply should have been received by the management not later than March 31st, some cases are still outstanding. Many forms have contained incorrect estimates of requirements, and non-electrical firms have frequently shown the greatest care in determining their probable demand!

The decorations of the building are incomplete at the time of writing, but show signs of being exceptionally

charming. The interior illumination of the hall will be extraordinarily brilliant; in addition to the large number of flame arcs permanently installed, arrangements are being made for the exhibition of numerous high-C.P. metallic-filament lamps, and the stalls themselves will, of course, be profusely illuminated. Already 10 32 ft. × 3 ft. 6 in. illuminated panel signs are promised round the gallery railings.

Our thanks are due to Mr. F. B. O. Hawes, secretary to the Exhibition, for his courteous assistance in the preparation of the above notes.

* * *

The external illumination of Olympia is in the hands of the Imperial Lighting Co., Ltd., and despite a recent fire at the company's works, there is every prospect of the following equipment being in full working order by to-morrow night.

The name of the exhibition, its opening and closing dates, and the words "Lighting, Heating, Cooking, Power," will be shown across the main entrance in letters 2 ft. high, lighted at night by about 400 16-C.P. metallic-filament lamps. Immediately over the main entrance there is to be a Union Jack traced out by correctly coloured lamps, and given the appearance of waving in the wind, by a motor-driven drum switch. To right and left of the flag will be two playing fountains, 16 ft. 6 in. in extreme height, and composed of five double sprays switched on successively by a drum type flasher so as to produce a realistic impression of motion. Under each fountain there will be arranged a zig-zag flashing device imitating lightning; at the conclusion of each flash, the words to right and left of the device will light up. At the right and left terminations of the dome contour will be powerful searchlights throwing inwardly inclined beams across the word "Olympia," and thence on to the sky. Finally, the main outline of the building will be marked by festoons of coloured lamps.

The flashing lamps will be of the carbon-filament type, 30-watt, 8-C.P., 220-volt units being employed. The remaining incandescent lamps will have metallic filaments—nine 25-volt, 16-C.P. lamps being placed in series across 220-volt distributing cables. In all, about 1,500 incandescent lamps will be employed, and roughly one quarter of these will be on "living" circuits. Specially designed drum flashers, driven by $\frac{1}{20}$-H.P. motors will control the fountains (five-ways), lightning flashes and wording. The total demand for the incandescent lamp circuits will be 135 amperes, and each of the large projectors will require 100 amperes. The projectors are specially neat and portable, and have been designed for this class of work by the Imperial Lighting Co.

The Exhibition management originally made strenuous efforts to secure co-operation between electric sign manufacturers in the provision of a really elaborate illuminating scheme, but unfortunately this could not be arranged. As a result the outlay had to be much more limited than would have been the case under the hoped-for co-operative plan, and under the actual circumstances, the Imperial Lighting Co. have provided a very satisfactory equipment.

**Electricity Supply from Sweden to Denmark.**—For some time a proposal has been under consideration to supply the city of Copenhagen with electrical energy from the waterfalls at Trollhättan, near Gothenburg, and the superintendent of the Board of State Waterfalls, Colonel Hansen, has now, after investigation, declared that the difficulties in connection therewith will not be very great. The Board of Waterfalls, however, will take no initiative themselves, but will leave it to the Government, who probably will lay the matter before the Rigsdag. Prof. W. Rung, one of the best Danish authorities on electrotechnical matters, seems to be somewhat sceptical over the scheme, and declares that he is not quite sure whether the electricity will be very much cheaper when supplied from Trollhättan, and that he himself would hesitate to advise it. He estimates the costs to be about £350-£450 per km. Another question is whether duty must be paid on electrical energy imported from a foreign country. On a former occasion an electricity works established at the free harbour of Copenhagen had to supply energy to one of the railway stations, and duty calculated according to the coal consumption was paid.

**A Berlin Chimney Falls.**—According to a London newspaper, a large chimney at the Berlin works of the Allgemeine Elektrizitäts Gesellschaft collapsed last Saturday, apparently owing to an explosion. Three persons were killed and seven injured by falling masonry.

## CORRESPONDENCE.

*Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

### Quartz in Electrical Heaters.

The undersigned was probably the first to employ manufactured quartz for electrical purposes, see Patent No. 14,899 of 1902, in which quartz capillary tubes are employed as containers for electric fuses; and Patent No. 3,259 of 1902, in which quartz is employed in connection with mercury vapour lamps.

**E. B. Schattner.**

London, S.W., *September 16th*, 1911.

In reply to Mr. M. Taylor's inquiry in your current issue, I think Mr. Bastian can unblushingly claim to have been the first to successfully apply quartz in his very practical and popular "Quartzalite" apparatus.

Exactly who was the first to apply it unsuccessfully would probably be a difficult fact to ascertain.

I think there was a company in Bristol which, some years ago, made a heating element consisting of a quartz tube stuffed full of some special resistance powder, but this device was apparently not satisfactory.

Andrews, of the American General Electric Co., was also an early experimenter, and has obtained patents in the United States only. He winds a wire on a tube and encloses that within a second outer tube, an unnecessarily clumsy arrangement, as it seems to me.

**Alfred A. Newman.**

London, S.E., *September 18th*, 1911.

### The Premium Pupil System.

In the current issue of the REVIEW your correspondent, "University Lecturer," somewhat light-heartedly criticises the Council of our senior Institution in connection with the recent Education Conference. He states that the whole business was futile, and expresses the opinion that no decision can be arrived at in a discussion between professors who naturally swear by college and consultants who represent the premium system.

Now, there can be very little doubt that many of those who have followed the proceedings will agree with your contributor as to the futility of the Conference, and I personally fully believe that the professors and the premiumites do not at present seem likely to "agree on some common course of action." When, however, "University Lecturer" goes on to say that the premiumites, who belong to a lost cause, have formed a "no surrender" party, and are "dying in the last ditch," &c., I feel called upon to take up my pen in the endeavour to prevent the perpetration of an injustice.

As to whether the premium system is dead or dying, let your correspondent refer to the opening remarks of the chairman of Sec. III of the Civil Engineers' Conference. It would appear that as a result of the Council's inquiry, it was found that "in 75 per cent. of the cases considered there were regular arrangements for pupilage, and in only 25 per cent. was no provision made for such regular practical training. . . . Of the 25 per cent., more than half the cases occurred in the engineering departments of municipal authorities."

In spite of the Council's figures, however, there will be many who will hold with your correspondent that the pupil system is really dead, and in this there is real danger, for if such a notion should become prevalent there is no doubt that the profession, as a whole, will suffer in the end. Experience of both sides has shown me that, so far as concerns electrical engineering at any rate, the possibilities of the premium system are very great, and it is astonishing how little they are realised.

Your correspondent says "it is beginning to be recognised that there is an art in teaching," *i.e.*, in imparting knowledge to the student. Quite so, to be able to teach well is an accomplishment possessed by few, but there is no monopoly held by university or college lecturers. I believe that these

gentlemen are developing their art in the wrong direction. Far better were it that they should cultivate less a capacity for imparting technical knowledge and instead endeavour to teach their students the art of learning. What fraction of the total acquired knowledge can the college trained youth apply directly to his work? Ask him six months after he has taken up his first job. Twelve months later he will have thoroughly forgotten most of that which he has not been actually using. He will, however, continue to learn for many years.

Alas, much of the time at college is wasted, and once a youngster has mastered elementary principles and acquired the art of learning, he will do well to seek out some firm who take their pupil system seriously.

It should be known, therefore, that it is possible in this way to develop theory and practice side by side under conditions which will make it easy for the pupil of average application and ability to rapidly out-distance his brother at college in all matters that are of importance to the normal engineer.

**University Graduate.**

*September 17th*, 1911.

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### Charging Ignition Batteries.

*Apropos* the article in the Review of September 8th on charging small accumulators: to avoid the waste of energy in charging through a lamp or bank of lamps, I find there is a great saving by charging off the regulating cells of the lighting battery through a resistance (an old motor starter can be used, or a length of, say, 14 S.W.G. iron wire can be rigged up on a frame, and can be tapped at a point to give the required ampères). Most works have ammeters more or less on the scrap heap, these can be rewound, if necessary, or possibly there are some old type disused voltmeters that only require rewinding and recalibrating. With regard to the two wires to be taken from the lighting battery end cells, one can be soldered to the lead bar of the last cell of all. The other, sufficiently long, is sweated to a connector that can be clamped to the lead bar of whatever cell is required to give the necessary voltage to charge a cell or a number in series.

**P.**

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### Lift Control.

Reading of the regrettable fatal passenger lift accident recently, I thought that this risk could be greatly minimised by the *stop* push being allowed to project, say, ½ in. or ¾ in., and be of a distinctive colour. As the general press buttons are black, the stop push should be ivory or bone. By this arrangement the lift could be much more readily stopped, and one would avoid the groping about with one finger to find the stop push as at present.

**Fred. J. Lorimer.**

London, N.W., *September 13th*, 1911.

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## BUSINESS NOTES.

**Russia.**—Poland.—The following information is from the report by H.M. Consul at Warsaw (Mr. C. Clive Bayley) on the trade of Poland and Grodno in 1910, which will shortly be issued.

A report from a reliable source in the Lodz district states that "there is a good opening for steam turbines and electrical installations generally. Very important orders for this class of machinery are constantly being placed in Germany. By far the greater number of steam, gas and oil engines continue to be imported from Germany and Austria. It is very seldom that an English-made steam engine is heard of as being sent into this district, and it is not by any means a question of price."

Electric light is practically always installed, either alone or in conjunction with gas. Birmingham electroliers and electric light accessories are both cheaper and better than those procured from Germany, but British manufacturers of these goods are very little represented in Poland.—*Board of Trade Journal.*

**Trade Announcements.**—The Wandsworth Electrical Manufacturing Co., Ltd., advise us that their agency agreement with Messrs. Galsworthy, Ltd., is now terminated by effluxion of time. The W.E.M. Co. have, therefore, made arrangements to open a depôt at 165, Wardour Street, W. Their new premises comprise commodious stores, and a large stock of all their manufactures will be carried. They have appointed their South of England representative, Mr. H. Bailey, as manager of the London depôt, with Mr. A. E. Blower as chief assistant. At their stand at Olympia (No. 244A) they show, besides the ordinary range of switches, main switches, main boards, &c., a complete selection of switches fitted with their patent earthing attachment to comply with the Board of Trade Regulations.

The business of the W. & L. Electrical Engineering Co., of Granville Street, Swinton, near Manchester, has been taken over by Messrs. Wm. & Jacob Turner Walmsley.

Messrs. E. Brook, Ltd., of Huddersfield, announce that Mr. Chas. H. Jessop is acting as their representative for London and the South from September 11th. He was until recently in the employment of the Langdon-Davies Motor Co., Ltd., and his present address is 163, King Street, Hammersmith, London, W.

Messrs. G. M. Boddy & Co. have removed from 15, Gray's Inn Road to 8, Leadenhall Street, E.C. (telephone No. 10503 Central), where they will supply the new "Mazda" drawn-wire tungsten lamps, which they have adopted since the recent patent litigation. Their 18 years' experience in the sale of electric lamps has enabled them to keep closely in touch with the successive improvements in manufacture, and their special feature at the Electrical Exhibition will be these "Mazda" lamps, which will be shown by them at stand No. 297. They have just issued a circular to the trade explaining the high qualities of the drawn-wire filaments.

The Eastern Electric and Trading Co., of Sukkur Sind, India, are jobbers of everything electrical, and commission agents, and they desire to get into touch with British manufacturers.

The International Institute of Technical Bibliography has removed to 68, Hampstead Way, London, N.W.

**Book Notices.**—"The *Journal* of the Institution of Municipal Engineers." Vol. III, No. 2. August, 1911. London: The Institution. Price 1s.

"*Journal* of the Franklin Institute." Vol. CLXXII, No. 3. September, 1911. Pennsylvania: The Institute. Price 50 cents.

"*Proceedings* of the American Institute of Electrical Engineers." Vol. XXX, No. 9. September, 1911. New York: The Institute. Price $1.00.

"*Journal* of the American Society of Mechanical Engineers." Vol. XXXIII, No. 9. September, 1911. Baltimore, Ind.: The Society. Price $1.00.

"*Boletin* de la Sociedad de Fomento Fabril." Vol. XXVIII., No. 8. August, 1911. Santiago de Chile: The Society.

"*Boletin* de Ingenieros." Vol. I, No. 12. August, 1911. Mexico: Secretaria de Guerray y Marina.

The *Journal* of the Tramways and Light Railways Association for September contains the recently published Board of Trade Regulations with respect to the use of electrical power on tramways, also a reprint of a paper on "Tramcar Meters, &c.," read by Mr. A. Sharman Giles, M.Inst.C.E., before the Institution of Civil Engineers.

*The Faraday House Journal* for September has been issued, and contains articles on "The Electrification of the Randfontein Central," "Finding the Neutral Point in C.C. Machines," &c., and the results of the Easter and Summer Examinations. The British Westinghouse Co., Brown-Boveri & Co., and the electricity works of Hornsey, Rawtenstall and York have joined the affiliation scheme of the Institution, whose new term begins on Monday, September 25th.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXVII, Part 9. August, 1911. London: Andrew Reid & Co., Ltd.

"Original Papers on Commercial Dynamo Design." By William L. Waters. 1911. London: Chapman & Hall. Price 8s. 6d. net.

"A Handbook on the Gas Engine." By Herman Haeder and W. M. Huskisson. 1911. London: Crosby Lockwood & Son. Price 18s. net.

**Electric Time Service.**—The Synchronome Co., of 32 and 34, Clerkenwell Road, E.C., inform us that among other important contracts for electric time services which they have in hand at present are the following:—London and North-Western Railway Stations at Harrow, Pinner and Bushey, and new offices at Euston; Webb Orphanage, Crewe; Royal Military College, Sandhurst; Vickers, Ltd., Westminster; Exchange Telegraph Co.; Lever Bros.' new offices, Royal Liver Buildings, Liverpool; Temple Press, Rosebery Avenue; Manchester Municipal Girls' Secondary School; Sheffield Training College; Farringtons Girls' School, Ltd., Chislehurst; County School for Boys, Bromley, Kent; St. Felix School, Southwold; Crawford Municipal Technical Institute, Cork; Coronation Clock Tower, Wednesbury; new Putney Hospital; Liebig's Extract of Meat Co.'s new offices, Queen Street Place; ss. *Laconia*, for the Cunard Steamship Co.; the Royal Naval Barracks, Shotley.

**Fire Precautions at Olympia.**—The Radium Fire Extinguisher, Ltd., of 67, Chancery Lane, W.C., has made arrangements to loan radium extinguishers to exhibitors for use on their stands during the period of the Exhibition at a nominal charge. We are informed that this extinguisher has proved its ability to deal successfully with fires caused by high tension electric currents, arcs of 2,000 volts having easily been extinguished under test conditions in London electric lighting works. It is also used on the City and South London and other electric railways.

**E.C.C. Staff Benefactions.**—The sum of £150 has been subscribed by the employés of the E.C.C., for the Wolverhampton Hospital Saturday Fund.

**Bankruptcy Proceedings.**—W. H. Illingworth, electrical engineer and dealer, Halifax and Leeds.—First and final dividend of 3s. 9¼d. in the £, payable September 26th, at Official Receiver's chambers, 12, Duke Street, Bradford.

Cuthbert Fenton Lindop, electrician, 16, Moss Lane, Aintree, late 62, Dale Street, Liverpool.—The adjourned public examination of the above debtor was held on Monday last at the Court House, Government Buildings, Victoria Street, Liverpool, before Mr. Registrar Cooper. The Deputy Official Receiver stated that on July 29th the debtor was ordered to prepare certain accounts, and he had only handed them to the Official Receiver on Saturday afternoon. There had been no time to examine them, even assuming them to be satisfactory, and it would be necessary to have a further adjournment. The examination was further adjourned.

**France.**—La Société Internationale des Accumulateurs Vedeka is the name of a new company which has just been formed in Paris, with a capital of £6,000.

La Société Francaise d'Industrie Electrique is the name of a new company which has lately been formed in Paris with a capital of £180,000. The new concern, which has taken over works at Colombes, will act as agents in France for Messrs. Ganz & Co., of Budapest, and Messrs. Dick, Kerr & Co., Ltd., of London and Preston.

**Dissolutions and Liquidations.**—J. G. Childs & Co., Ltd., electrical engineers, Hawthorn Works, Hawthorn Road, Willesden Green.—Under the compulsory winding-up order made last May on a creditor's petition, Mr. H. E. Burgess, Official Receiver, has now issued his report to the creditors and shareholders. The statement of affairs, as at March 31st, 1911, the date of the appointment of the Receiver for the debenture-holders, shows unsecured debts, £20,641; fully secured creditors, £3,714; other liabilities, £100 (not expected to rank); preferential claims, £296; and loans on debenture bonds, £5,452; making a total indebtedness of £30,202. The assets, which are entirely absorbed by the debenture and preferential claims, are valued at £3,410, and consist of cash, £1 15s.; stock-in-trade and work in progress, £1,000 (estimated cost, £4,040); machinery, £1,000; trade fixtures, fittings, &c., £200; office furniture, £20; drawings, plans, patterns, &c., £300; and book debts, estimated to produce £888. The account with the contributories discloses a deficiency of £41,061, which is explained as follows:—Excess of capital and liabilities over assets on September 30th, 1910, as per company's balance-sheet, £14,939; estimated gross loss on trading as per account to March 31st, 1911, £7,947; expenses of carrying on business from September 30th, 1910, to date of winding-up order, £3,070; losses and depreciation not written off in company's books, now written off by directors:—Stock-in-trade and work in progress, £3,040; plant and machinery, £1,491; wind-turbine development, £2,070; patents, £528; bad debts and discounts, £366; drawings, experimental work, plans and patterns, £1,421; goodwill, £5,979; other losses, £2,257 = £17,153; making £43,109; less increase in valuation of buildings, £2,048; leaving the deficiency as per statement of affairs, £41,061.

According to the report of Mr. Burgess, the company was incorporated on December 27th, 1901, with a nominal capital of £20,000, and was formed to acquire and carry on the business of electrical engineer belonging to J. G. Childs. The capital was by special resolution on February 20th, 1902, divided into 10,000 6 per cent. cumulative preference and 10,000 ordinary shares of £1 each. The nominal capital was increased on April 4th, 1907, by the creation of 3,575 second preference shares of £1 each. The first directors of the company were J. G. Childs and H. Turnbull, who were appointed under the articles of association. Other directors appointed were T. S. Hill, on January 29th, 1902, and R. and A. E. Phipps, on February 3rd, 1910. H. Turnbull resigned on December 31st, 1906, and R. Phipps died in the early part of 1911. The other directors remained on the board until the date of the winding-up order. The business acquired by the company had been carried on by J. G. Childs for two years, and according to his books a profit of £543 had been made during the year preceding the sale to the company. Further working capital becoming necessary, Messrs. Hill and Turnbull agreed to invest £2,000 each in the business. By an agreement dated January 3rd, 1902, the company purchased from J. G. Childs the goodwill and assets as at June 30th, 1901, for the sum of £5,300, payable in fully paid shares of the company, and the company undertook to discharge certain liabilities of the business, which amounted to £1,950. The assets taken over appear in the books as follows:—Sundry debtors, £1,237; plant, machinery, stock, &c., £1,012; goodwill account, £5,001 = £7,250. No prospectus was issued, the share capital issued for cash being taken up by the directors and their relatives. The amount issued for cash was as follows:—Ordinary shares, £3,007; first preference shares, £6,200; second preference, £3,575. In the autumn of 1902 the company was in need of financial assistance, and commenced borrowing money from two of the directors, viz., Messrs. T. S. Hill and H. Turnbull. Mr. Turnbull continued advancing money until February, 1906, and in April, 1907, the amount of his loans, aggregating with interest £3,575, was satisfied by the issue of 3,575 fully paid second preference shares, and a release from certain guarantees of the company's debts given by him. At the date of the last issued balance-sheet T. S. Hill's loans to the company amounted to £14,832; against this amount debentures for £4,600 were issued to him, reducing his claim on loan account to £10,232. Additional advances since have increased the company's debt to him by upwards of £2,000. In June, 1903, the company took more convenient and suitable premises at Hawthorn Road, Willesden Green, on a lease for 99 years at a rental of £135 per annum. The lease was granted free of cost to the company, but contained a proviso that £800 should be spent upon the buildings. According to the company's books the building account was debited at various times with sums which total £1,653. On March 3rd, 1904, the lease was mortgaged to Mr. S. Hill in consideration of a loan of £3,000. This loan is still outstanding, and appears in the last balance-sheet with interest at £3,629. The directors acting at this date guaranteed the repayment of the loan with interest, but Turnbull was subsequently released from his liability under this head. The company's trading, which consisted chiefly of the manufacture and sale of electrically-controlled lifts, was carried on throughout at a loss. Profit and loss accounts and balance-sheets were prepared and audited for the years 1902 to 1910. The loss on the respective years is stated as follows:—

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 25 months to July 31st, 1903 | .. | .. | .. | .. | .. | £3,004 |
| 12 | " | " | " | 1904 | .. | .. | .. | .. | .. | 2,525 |
| 12 | " | " | " | 1905 | .. | .. | .. | .. | .. | 1,928 |
| 12 | " | " | " | 1906 | .. | .. | .. | .. | .. | 1,561 |
| 12 | " | " | " | 1907 | .. | .. | .. | .. | .. | 676 |
| 12 | " | " | " | 1908 | .. | .. | .. | .. | .. | 1,341 |
| 12 | " | " | " | 1909 | .. | .. | .. | .. | .. | 1,188 |
| 14 | " | Sept. 30th, 1910 | .. | .. | .. | .. | .. | 2,821 |
| Total loss | .. | .. | .. | .. | .. | £14,999 |

On February 21st, 1908, an issue of £5,000 6 per cent. first mortgage debentures was authorised in general meeting. These debentures, with the exception of £400, are entered in the company's books as having been issued to T. S. Hill, and his loan account is debited accordingly with £4,600; but in fact the debentures were handed by Hill to various other creditors of the company, excepting £1,000 which Hill has lodged with his bankers as part security for an overdraft of about £13,500 in respect of money obtained at various times and lent to the company. Hill has personally guaranteed the repayment of the overdraft. In October, 1908, the directors resolved to take up the manufacture of wind-turbines, incorporating certain inventions of J. G. Childs relating thereto. Considerable expense was incurred in developing and advertising the wind-turbines, and a small number was sold, about five in this country and four abroad to Canary Islands, Argentine, Granada and Australia. In December of 1909, with a view to relieve the financial pressure, attempts were made to float an independent company to take over this branch of the business, but the negotiations to this end fell through. The sum of £1,569 stands to the debit of the wind-turbine development account, this amount having been arrived at after deducting sales aggregating £1,121. The company's interest in this invention and in all patents vested in Childs and Hill, the fees on which were paid by the company, consists of three-fifths of the foreign patents and an assignable licence to manufacture the inventions in England. The directors decided in March, 1910, to move to new premises at South Fambridge, in Essex. Messrs. Childs and Hill had there acquired the equity of redemption of 2 acres of land and buildings thereon for about £100. Mr. R. Phipps subsequently provided the money required to pay off the existing mortgage on the property, and refunded to Childs and Hill the money paid for the equity. The company was only a tenant at will, and was not interested in the freehold. The premises were equipped with the necessary plant, and the manufacture of wind turbines and lifts was commenced there. The amount expended on plant and buildings is stated to have been about £1,600, in addition to which the expenses of removal amounted to £257. The directors state that this removal was for economy, the intention being to carry on the mechanical part of the business there, while the construction of woodwork for the lifts was continued at Willesden. Under the instructions of the company Childs went to the United States in October, 1910, to effect a sale of the American patent rights relating to wind turbines in that country, and the board granted a power of attorney giving him authority to dispose of such rights in any manner he might think best. Certain negotiations took place, but no sale has been effected, and the power of attorney given by the company has expired. On March 31st, 1911, Mr. H. W. Freshwater, of 7-8, Railway Approach, London Bridge, was appointed Receiver on behalf of the debenture-holders under powers contained in the debentures, and since that date he has been in possession of, and is realising, the company's assets, and completing a number of unfinished contracts. His estimate of the value of these contracts is as follows:—Amount estimated to be payable under the contracts £2,577, less amount already expended by the Receiver, and approximate amount required to complete, £1,400; estimate of amount to be realised, subject to Receiver's charges, £1,177. The Receiver has expressed the opinion that the assets will not realise sufficient to satisfy the claims of the debenture-holders. The failure and insolvency of the company are attributable chiefly to contracts having been undertaken at prices which were not remunerative, and to excessive expenditure in carrying on the business. The liquidation has been left in the hands of the Official Receiver.

Midgley's Electro-Therapeutical Co., Ltd.—A meeting is called for October 17th, at Manchester, to hear an account of the winding up from the liquidator (Mr. F. Murgatroyd.)

W. & L. Electrical Engineering Co., general electrical engineers and contractors, Granville Street, Swinton, near Manchester.—Messrs. J. T. and W. Walmsley and E. W. Lucas have dissolved partnership. Debts, &c., will be attended to by Messrs. Walmsley, who will continue the business under the same style.

**Small Lighting Plants.**—We have received an inquiry, emanating from a foreign source, for "a good and reliable make of gasoline engine and dynamo for 20 up to 50 lights, complete with switchboard, &c., easy to install and to keep going." If there are any made for less that 20 lights, particulars of these are asked for. So many makers have taken up this line that we have no doubt that there will be numerous replies—which may be addressed to this office.

**Catalogues and Lists.** — The London Electric Firm, George Street, Croydon. — We have received an advance proof of the firm's new catalogue (No. 190), in which, in the course of 112 pages, are given very fully illustrated particulars of their "one working part" arc and metal-filament lamp lowering gear and self-sustaining winches. The firm have, as our readers are aware, specialised for a very long time in this department, and central station engineers, contractors and others will find it useful to have at hand this complete and up-to-date record of the different types and prices. There are diagrams and photographs of actual installations of all special types of gear, namely, central carrier, two-stage, span wire and inverted gear, &c., as well as ordinary swan neck and rectangular pillar street lighting. Examples of converted centrally hung lamps at Eastbourne, Grimsby, Cardiff, Ealing, Oxford Street, London, Westminster, Ilford, &c., are shown. The firm undertake complete change-over jobs anywhere, relieving borough and other engineers of trouble and responsibility, and 50 pages of illustrations show specimens of what they have done under such arrangements. For the convenience of contractors and others a number of catalogues have been printed without the firm's name. The firm keep a large stock of their manufactures. Of current interest in the list there is an illustration of Olympia indicating that their gear is fitted to large lamps inside the building.

Messrs. Lacy-Hulbert & Co., Ltd., 91, Victoria Street, Westminster, London, S.W.—A number of leaflets containing illustrated descriptions, with drawings and dimensions, prices and other particulars of "Boreas" rotary pumps, electric air compressors, vertical belt-driven air compressors, and small "Class V" compressors.

The Selas Lighting Co., Ltd., 5, Newcastle Street, Hulme, Manchester.—32-page catalogue (art paper) giving descriptions of the "Selas" flame arc lamps, enclosed arc lamps (direct) for D.C. and A.C., true colour matching lamps, semi-direct and indirect shadowless illuminating enclosed lamps, and particulars of various spares, line resistances, raising and lowering gears, and pulley blocks, winches, arc lamp brackets and carbons. The catalogue is well illustrated, showing interiors and exteriors of the different types of lamps, and prices and general particulars are tabulated. A table of "Selas" auto-transformers (40 to 100 cycles), their sizes and prices, appears at the end. Copies of the catalogue can be obtained by the trade.

The Radium Electric Co., 82, Hatton Garden, London, E.C.—Illustrated price list of "Radec" metal-filament lamps, with pear shape, round, and candle shape bulbs.

The India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd., Silvertown, London, E.—24-page list (No. 40A), giving a large number of tables of particulars, pattern numbers and prices of twin, concentric and high-tension cables, flexible conductors and cords.

Messrs. Falk, Stadelmann & Co., Ltd., 83-87, Farringdon Road, London, E.C.—Several leaflets for the 1911-12 season, setting forth particulars and prices of their "Efesca" metal-filament lamps for domestic and general use, and for street and other outside lighting; one of the sheets shows and particularises, with prices, their auto-transformers.

Messrs. Schoen Bros., 29-30, Cock Lane, Snow Hill, London, E.C.—16-page illustrated and priced catalogue of electrical novelties, miniature lighting, accessories, pocket lamp cases, small motors, induction and medical coils, &c.

Messrs. Julius Sax & Co., Ltd., 24A, High Street, New Oxford Street, London, W.C.—Several illustrated and priced leaflets showing lampholders, vitreous china wall plugs, and "Goliath" electric bell wire.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Leaflet giving thicknesses, weights, diameters, &c., of aluminium tubes.

The Auto-Lift and Runway Co., 44, Miller Street, Manchester.—Sixteen-page pamphlet containing illustrated descriptions and prices of hand and electric pulley blocks, crabs, jib cranes, electric friction hoists, electric transporters, &c.

Messrs. E. Bennis & Co., Ltd., Little Hulton, Bolton.—New pamphlet of 20 pages, containing descriptive notes regarding the Bennis new-link chain-grate stoker and its evolution. Some instances of individual installations are illustrated, these including Kensington and Notting Hill joint electric lighting station, Central Electric Co.'s station, Leeds and Coventry electricity works. The results of boiler tests made at some of these and other stations are tabulated.

The British Thomson-Houston Co., Ltd., 83, Cannon Street, E.C.—Price list No. 310 of the B.T.-H. "Gem" lamp. This is now made at Rugby, and represents the highest development of the carbon-filament lamp, the filament being raised to an extremely high temperature in the electric furnace in the course of manufacture, with a resulting gain in efficiency of 25 per cent. compared with the ordinary carbon lamp, with an equal life and very slight increase in price. It is made of 16 C.P. at 100-130 volts, consuming 45 watts, with a life of 1,500 hours, but can be supplied of 20 C.P., taking 50 watts, with a life of 800 hours. The resistance of the filament varies with temperature, like that of metals, so that it is less affected by variations of voltage than the carbon lamp. It is stated that eight million "Gem" lamps are in use in the United States.

The Westinghouse Cooper Hewitt Co., Ltd., 151-2, Great Saffron Hill, E.C.—We have received an excellent little brochure entitled, "Better than Daylight" (Form No. 94), in which the advantages of the Cooper Hewitt lamp for the textile trades are convincingly set forth. There is no doubt that workpeople like the light when they have become accustomed to it. A list of factories in which the lamp has been adopted, would, we think, be a useful addition to the booklet.

Messrs. Simplex Conduits, Ltd., Birmingham.—Weekly mailing card giving prices and illustration of their electric boot polisher. These machines are made from ⅓ to ½ H.P. for D.C. with shunt-wound motor, and for single or three-phase A.C., with induction motor.

Messrs. Tyler & Freeman, of 20, New Bridge Street, E.C., have sent us a pamphlet briefly describing the more important works which they carried out in 1910; it is well illustrated, most of the views showing large country houses in which complete installations were erected by the firm; many large works were also equipped by them, including those of Messrs. Aveling & Porter, which are now entirely driven by electricity, with motors of over 500 H.P. Repton Schools, and the new engineering workshops of the Central Technical College, are amongst the many buildings in which installations were carried out.

**Exhibition Awards.**—Messrs. R. Wolf have been awarded the Grand Prix for their "Wolf" superheated steam locomobiles shown at the Exhibition of the North of France at Roubaix, also the Gold Medal of the Imperial Russian Ministry of Industry at Odessa. These honours complete a series of highest awards obtained by these locomobiles this year at the exhibitions at Omsk, Siberia (two Gold Medals), Crefeld (Germany), Allahabad, India (Gold Medals). Last year distinctions were gained at Brussels and Buenos Ayres.

## LIGHTING and POWER NOTES.

**Bacup.**—The T.C. has decided to apply to the L.G.B. for a loan of £1,250 for electricity purposes.

**Bath.**—On Friday last an inquiry was held relative to the application of the T.C. for a loan of £7,900 for E.L. purposes, viz., the installation of a Diesel gas engine and a booster. The Inspector added to the amount £100 for contingencies. There was no opposition.

**Bitton.**—The Coronation memorial at the village of Bitton has taken the form of public lighting by electricity, and the current was switched on September 14th.

**Brighton.**—In a recent report to the Town Council, Mr. Christie recommends certain simplifications of tariffs and the abolition of meter rents; these concessions will involve a loss to the central station, which will be compensated within a few years at most by the increased demand resulting. The present tariffs (6d.-2d. on maximum demand system; 3d. flat to hotels, &c.; 4d. to flat to shops and private consumers), are to be *gradually* replaced by a common 3d. flat rate free from meter rent. The adoption of this proposal would involve £600 reduction on the current year's revenue. The complete abolition of meter rents would result in a loss of revenue of £1,200 per annum, but in a few years this amount would be recouped by the extended demand. The cutting off of supply between 5.30 p.m. and 8 p.m. during December and January would have to be abolished. Last year 173,576 units were sold at 1½d.; the estimated loss by the concession (£361) would be neutralised by the increased demand among breweries, laundries, &c. A flat power rate of 1½d. was proposed.

The T.C. has been recommended by the Lighting Committee to install an air-pump (motor-driven) at the electricity works at a cost of £635, and an electrically driven circulating pump, at a cost of £229, with an expenditure of £656 for alterations to cables, &c.

**Burnley.**—The Corporation has applied to the B. of T. for a prov. order to supply electricity within the residential district of Reedley Hallows, which is just beyond the borough boundary.

**Burnham (Som.).**—The U.D.C. has decided to apply for a prov. order to light the sea front and a number of the streets of the town by electricity. The population is 3,000, with an increase of nearly double in the summer months.

**Carlisle.**—Out of the profits of the electricity undertaking for the past year, £1,000 is being transferred to the city fund, the remainder being carried forward as a working balance.

On the engineer's recommendation and to comply with B. of T. requirements, the Electricity Committee has agreed to the provision of new feeder and battery switchgear, to make certain alterations, and to erect a new steel staircase at the electricity station, at a cost of £600.

**Cavan.**—At the last meeting of the Council a proposal to light the town by electricity at a cost of some £7,500, resulted in a committee being appointed to confer with the gas company with a view to the purchase of the concern, a report to be furnished to the next meeting.

**Colombia.**—The *Diario Oficial* of August 2nd notifies that a contract has been entered into between the municipal authorities of Riosucio and George Gartner, empowering the latter to construct an electric generating station for the purpose of supplying electric light to the inhabitants of Riosucio.—*Board of Trade Journal.*

**Continental Notes.**—France.—The *Standard* states that the Ministerial proposal for four new series of taxation includes a general tax on gas, electric, and other lighting. Lighting for public or industrial purposes is to pass free, and so are the lights on vehicles, but there is to be a tax of one-twentieth of a penny per hectowatt-hour for electricity and one-tenth of a penny per cubic metre of gas. Calcium carbide sold for lighting purposes is to pay one and eightpence per hundredweight. Electric lamps are to pay from a halfpenny (10 watts) to threepence halfpenny (300 watts), with a double tax on metallic-filament lamps. There is to be a special tax of half-a-crown a yard on the tubes of mercury vapour lamps and three halfpence on each incandescent gas burner. Arc lamp carbons are to be taxed a penny a pound, and incandescent mantles are to pay a halfpenny each.

Sweden.—Two turbines of 10,000 h.p. each are now being installed at Trollhättan, which will increase the capacity of the works to 60,000 h.p. At the present time contracts have been entered into for the supply of 25,000 h.p., and negotiations are being carried on for the supply of another 5,000 h.p. It is anticipated that a great portion of the additional power available will be transmitted along the line Uddevalla-Lysekil, and in particular to some new stone quarries which are going to be opened on the west coast. A new transmission line is also being built to the town of Falkjöping. The question of supplying electrical energy to Copenhagen from the Trollhättan Works has been raised again in earnest, as it has now been proved that the inland demand is not so great as was anticipated, and is not likely to grow so rapidly within the near future as to be capable of absorbing the whole amount of power available.

**Croydon.**—On Monday the B.C., on the recommendation of the Lighting and Electricity Committee, decided to expend £1,700 in laying a new feeder from the electricity works to the Drummond Road sub-station. The borough electrical engineer (Mr. A. C. Cramb) described this as a necessary alternative route, to give a reasonable chance of the supply being restored without delay, in case of failure on one feeder. Councillor Houlder, on behalf of certain objecting householders, drew attention to a circular offering electricity at 1d. per unit where it was used for heating, cooking and lighting, the agreement being that if the householder failed to use electricity alone for lighting purposes, the charge should be 1½d. Alderman Miller (chairman of the Committee) said the Council had authorised the charge. Councillor Houlder replied that that might be, but there was general dissatisfaction among users of electricity, and he would bring up the matter again later.

**Douglas.**—The T.C. is considering the advisability of providing an electric light undertaking and of electrifying the tramway system, and has retained Messrs. Handcock and Dykes to report.

**Egham.**—The erection of the new power station of the Staines and Egham Electric Lighting Co., of which it is expected the Lord Mayor of London will lay the foundation stone on 30th inst., is proceeding on the Causeway at a convenient situation between the two towns to be supplied with electricity.

**Great Harwood.**—A plan has been submitted to the Council giving details of the electric lighting scheme drawn up by Mr. J. W. Speight.

**Gellygaer.**—The U.D.C. has decided to obtain an estimate for lighting by electricity the whole of the Fochriw and Deri wards of the town.

**Glasgow.**—By the casting vote of the chairman, the T.C. Electricity Committee has decided to recommend that the Corporation be not represented by deputation at the Electrical Exhibition, Olympia, London.

**Hastings.**—The T.C. has received the sanction of the L.G.B. to a loan of £581 for extension of electric light mains in several roads, the authorised period being 25 years. Final arrangements have now been made between the Hastings Corporation and the Guardians for the extension of the electric light mains to enable the scheme for the electric lighting of the workhouse to be carried out. The Guardians are inviting tenders up to October 18th for an installation. Specification from the Clerk to the Guardians, Wellington Square, Hastings. There are 400 inmates, and it will be the biggest group of buildings in the town to be installed with the electric light.

**Hayward's Heath.**—An effort is being made to have the E.L. introduced into the district.

**Itchen.**—The U.D.C. has, by nine votes to four, declined to rescind the recent resolution in favour of the Council applying for a prov. order for electric lamps.

**Kirkburton.**—The U.D.C. has consented to the Yorkshire Electrical Distribution Co., Ltd., giving a demonstration of public lighting with electricity.

**Kilsyth.**—A London company has intimated its intention to apply for a prov. order, but the Council is divided on the question, and the matter stands delayed for a month.

**Lancashire.**—A correspondent states that electricity on a fairly extensive scale will be used in connection with the new collieries for which the Clifton and Kearsley Coal Co. are now sinking shafts at Astley, in South Lancashire.

**Lepton (near Huddersfield).**—The U.D.C. has given permission to the Yorkshire Electric Power Co. to make additions to the overhead lines at Rawley, subject to the footpath being suitably protected.

**London.**—Shoreditch.—As the result of increases in the prices of fuel, additional extensions and renewals in the generating station, and the conversion of 1,055 gas lamps to electricity, the annual estimates to March 31st, 1912, were increased by £1,947 to £51,511. The net reduction in anticipated revenue, due to reduced tariffs, is £2,512 (allowing for probable extensions). The amended estimates provide for the spending of £26,379 during the six months ending March 31st, 1912, the estimated surplus at the latter date being then £4,772, instead of £7,025, as originally estimated. Following the completion of the conversion of the street lamps south of Old Street from gas to incandescent electric lighting, it is now proposed to replace gas lamps north of Old Street by metallic-filament lamps. A number of the streets in which it is proposed to lay cables offer an immediate demand for general lighting and power supply, and many others offer prospects of developments in the near future. There are at present 1,055 gas lamps in the district in question, and in 160 streets it is proposed to lay about 14 miles of cables at an inclusive cost of approximately £8,385. In the ordinary side streets it is proposed to lay cables capable of supplying 25 h.p., and in the smaller streets a cable capacity of 6 h.p. is suggested. The cost of converting the lamps is estimated at £665 5s., and the whole outlay will be distributed over several years. Important revisions have been adopted in the present charges for power and factory lighting supply, especially as regards an alternative to the maximum-demand system, which many consumers fail to understand. The new tariffs are so framed as to benefit both large and small consumers, and special discounts are to be granted for early settlement of accounts. The tariff modifications are :—

A flat rate of 1·25d. per unit for power supply of not less than 1,250 units per quarter, with a load factor of at least 10 per cent. and a sliding scale of discounts ranging from 5 to 20 per cent., according to demand (5 per cent. for 2,500 and under 3,750 units per quarter; 10 per cent. for 3,750 and under 5,000 units; 15 per cent. for 5,000 and under 6,250 units; 20 per cent. for 6,250 units and over). Where factory lighting consumption equals 5 per cent. of the power consumption, a further 2½ per cent. discount is to be allowed on the power rate. The maximum power tariffs are to be 1·5d. for supplies of at least 10 per cent. load factor, and 2d. where the load factor is less than 10 per cent.

For factory lighting a flat rate varying from 3·25d. for less than 3,750 units per quarter down to 2·5d. for 6,250 units and over is adopted; if electric power is not used, all factory lighting demand is to be charged at 3·25d. per unit.

To encourage contractors and others to make an effective display of electrical fittings and accessories, electricity shall be supplied to electrical showrooms at 2·5d. per unit.

In March, 1910, the public street arc-lighting tariff was reduced from 2·25d. to 1·9d. per unit (equivalent to £1,100 per annum), and it is now further reduced to 1·5d. per unit (£1,292 per annum on last year's figures). Public offices in all departments of the Council are to be supplied at 3·5d. per unit for lighting purposes (estimated annual saving to rates = £70). The revised charges are to take effect after the September meter readings, and are to be alternative to the existing tariffs. The discounts quoted will only be allowed on quarterly accounts paid within one month after the quarter, on monthly accounts paid within 15 days, or on weekly accounts paid within seven days.

St. Pancras.—The Finance Committee has decided in favour of utilising £6,977 of the £13,203 profit on the electricity undertaking for the year ended March 31st, 1911, for the relief of the rates. The Electric and Public Lighting Committee has decided to continue the central arc lighting in the widened portion of Euston Road, and to re-arrange the existing arc lamps. Mains are to be extended in three streets at an estimated cost of £65.

Bermondsey.—Agreements are to be entered into with the following firms for the supply of energy at special tariffs: Cartwright Bros., Union Road; Grant & Co., Riley Street; Barrow Bros., Ltd., The Grange; Bevington & Sons, Abbey Street. The Electricity Committee reports the loss of about 75,000 units owing to many of the consumers shutting down their works in consequence of the late strike. The effects will also be felt in the present month, which means a serious loss of revenue to the undertaking.

Marylebone.—A meeting of electrical contractors in the borough was held recently, when a resolution was passed protesting against the continued existence of the sales department of the B.C. as being unnecessary and unfair, and objecting to the methods adopted by the department in making use of the information obtained by it as the electricity authority to enter into unfair competition. It is hoped that the resolutions when brought before the Marylebone B.C. on October 5th will open a way for the contractors to state in person their complaints against the conduct of the municipal electrical undertaking.

Hammersmith.—The Electricity Committee reports that on November 13th, 1907, the Council agreed to supply Messrs. Gwynnes, Ltd., with one 50-h.p., four 30-h.p., one 18-h.p., and three 10-h.p. motors, in addition to one spare motor, and a motor-generator upon hire, subject to the company entering into an agreement to take from the Council a supply of energy for a minimum period of five years, paying not less than £1,000 per annum for energy supplied at the standard rates of 1d. per unit for power, and 3d. per unit for lighting, this price to include any charge for the hire of the motors. Messrs. Gwynnes have again

approached the Electricity Committee with a view to the Council supplying on loan three additional motors, which the company state would be required in connection with large additions which are about to be put down to their electrical plant. The Committee state that the estimated cost of the additional motors would be £500, and that under their agreement the company had taken much more than the minimum supply stipulated. The company state that they would be willing to enter into a fresh agreement on the lines of the present one for a further period of five years. Accordingly the Committee has decided to purchase the motors required, and lend same to the company in consideration of them agreeing, in a form to be approved by the Council, to take a supply of current for a further period of five years on the terms of their present agreement.

**Mansfield.**—The L.G.B. has sanctioned the borrowing of £3,500 in connection with the proposed extensions to the electricity undertaking.

**Mansfield Woodhouse.**—Steps are to be taken to give a supply of electricity to Mansfield Woodhouse in accordance with the terms of the order. The details are to be considered at a future meeting.

**Middlesbrough.**—It is stated that important improvements at Middlesbrough Dock are contemplated by the North-Eastern Railway Co. The improvements include the substitution of electric cranes of greater radius for the present hydraulic cranes on Nos. 3 and 4 quays, and the provision of an electrically driven steel-belt coal conveyor.

**Newbury (Berks.).**—The electric light has been installed in St. Nicholas' Church, and it was used for the first time on Sunday. The installation has been carried out by Messrs. Cash, of Westminster, under the scheme of Mr. Pooley, Westminster.

**Penistone.**—The Council has given its formal sanction for the Yorkshire Electric Power Co. to lay underground cables to the various works in the Penistone area.

**Poole.** — The Bournemouth and Poole Electricity Supply Co. having applied for an extension of time for a year for carrying out the Wimbourne and District E.L. order, 1905, the R.D.C. has decided to raise no objection.

**Radcliffe.**—The L.G.B. has informed the U.D.C. that it may commence main extensions and the installation of water softening plant, for which a loan of £1,800 has been obtained, without waiting formal sanction, on the understanding that if the Board finds itself unable to sanction a loan the sums expended must be met out of current revenue.

**Sheffield.**—The electricity accounts for the 12 months ending March 25th, 1911, show a surplus of £3,417, as against a deficit of £2,035 for the previous year. The total generating costs have fallen from 0·555d. to 0·472d. per unit. Practically the whole of the increase in the total sales is in the power supply, but for the first time since March, 1908, the units for lighting show an increase on the previous year. The effect of metallic lamps on the station and consumers respectively and the rapid development resulting from the cheapening of electricity supply are shown by the following figures:—

| | Lighting units. | Lighting revenue. | Additional consumers. |
|---|---|---|---|
| 1908 .. .. | 3,978,256 | £59,410 | — |
| 1909 .. .. | 3,821,340 | £58,117 | 217 |
| 1910 .. .. | 3,541,572 | £46,264 | 209 |
| 1911 .. .. | 3,678,444 | £45,873 | 399 |

The Electricity Committee recommends the transference of a further £5,000 from the accumulated surplus to the renewals fund. The extensions at Neepsend will be available for the coming winter, and further extensions will be executed next year. The total sales and the total revenue (£86,000) both constitute records; the power sales show an increase of 3,804,486 units (56 per cent.). The increase in total revenue is £10,890; in costs £4,370; in interest and sinking fund, £1,067. The capital expenditure to March last totals £993,525; the amount paid into sinking fund, with accumulations for debt redemption is £194,440 (to March, 1911).

**Swinton (Lancashire).**—The British Advertising Co. have applied to the local D.C. for a supply of current for the lighting of a picture hall in Elm Street. The Earl of Ellesmere has granted the Council permission to erect four poles for an overhead service, at a rental of 2s. 6d. per pole per annum, for electricity supply to Little Wardley Farm. His lordship states that he is not prepared to grant permission for the three further poles required to serve Messrs. Holland's mineral waterworks. The Council last week resolved that the proposed supply be not considered.

**Swinton and Pendlebury.**—The U.D.C. has appointed a committee to consider what action shall be taken in connection with the electricity undertaking on the expiration of the existing agreement with the Lancashire Electric Power Co.

**Torquay.**—The T.C. has received sanction from the L.G.B. to a loan of £5,250 for additional plant at the electricity works.

**Worsley.**—The Swinton and Pendlebury D.C. has deferred dealing with the proposed supply of electricity to the Broad Oak Park district of Worsley until the question of dealing with the general supply of the district is considered.

**Whitby.**—The U.D.C., on Saturday, opened, in the Council Chamber, a week's exhibition of cooking and heating by electricity.

## TRAMWAY and RAILWAY NOTES.

**Australia.**—The *Australian Mining and Engineering Review* states that the Prahran-Malvern Tramways (V.) for the year ending June 30th earned a revenue of £25,822, the car-mileage run for the year being 475,353. No fewer than 3,706,180 passengers were carried during the period under review. An addition to the rolling-stock is to be made by the construction of four closed bogie cars, which have been ordered for delivery by November next. The total cost of each car will be approximately £1,500. The track has been extended along High Street, Prahran, to Punt Road, with satisfactory results; but the trust is anxious to carry the extension to St. Kilda Road, as a connection would then be established with the city cable lines. The duplication of the High Street line and its extension to Glen Iris station is being reported upon by Mr. Dix, the trust's engineer. It is also proposed to link the Caulfield and St. Kilda lines with the trust's system. The requisite material for the Dandenong Road line is now arriving. Contracts have been let as follows:—

Rails, fishplates, &c.—Messrs. Noyes Bros. Pty., Ltd., £6,624.

Special work, points, and crossings.—Messrs. Edgar Allen & Co., Sheffield, £1,926.

Overhead construction.—British Insulated and Helsby Cables, Ltd., £4,550.

Centre and side poles.—Noyes Bros. Pty., Ltd., £657.

Permanent way.—Younger & Howitt, schedule rates.

The *Daily Chronicle* correspondent at Melbourne says that on 13th inst., the Royal Commission on the Metropolitan Traffic of Melbourne reported favouring the electrification of suburban railways and trams, vesting the latter in a Greater Melbourne Council. Pending the creation of the latter body the trams should be controlled by a special State-cum-Municipal trust of 12 paid members. The scheme involves the buying of the existing cable tram company and the erection of an enormous State power house to supply the trams and trains. The capital expenditure will exceed five millions.

Reuter's agent at Sydney states that the Government has submitted to Parliament proposals for the construction of new branch railways and other public works at an estimated cost of £8,000,000.

**Bath.**—The Bath Electric Tramways, Ltd., have applied to the B. of T. for a further extension of time for two years for the construction of the light railways in the rural district and Keynsham.

**Canada.**—The B. of T. have received a copy of an Act, passed on March 31st last by the General Assembly of the Province of Nova Scotia, authorising the granting of aid under certain conditions to companies proposing to construct electric railways in the province. The aid may take the form of (*a*) a subsidy not exceeding $2,000 (about £410) per mile; (*b*) a loan not exceeding $8,000 (about £1,640) for each mile of electric railway built and worked; (*c*) a guarantee of the bonds or debentures issued by the company.—*Board of Trade Journal.*

**Cardiff.**—The annual report of the electric lighting and tramway department to March 31st last, shows very satisfactory results. The 1910 record tramway results have been considerably bettered, and the readjusted fares and stages have been fully justified. The surplus tramway balance is £12,034, an increase of £1,002 over 1910. Actual working expenses increased £2,063 (from £74,378), but the income rose from £130,565 to £135,394 (£4,829 increase). The whole of the generating plant has been brought up to date. The motor-generator plant transferring the Canton Station day-load and part of the evening load to Roath power station has resulted in a gain to the lighting department of £2,787. The depreciation fund has risen from £36,627 to £44,515. The total car-miles was reduced from 2,514,648 to 2,475,542, but the number of passengers carried (25,662,830), showed an increase of 214,596. The percentage of tramway working expenses to receipts fell from 57·1 to 56·1 per cent. The workmen's cars show a loss of 4·25d. per mile (£1,566 per annum). No fewer than 2,540,112 transfer tickets were sold during the year ending March 31st (value, £10,583 16s.; increase in number 351,938). There is a tendency to interfere with the transfer system by lengthening stages. Further concessions are, as yet, impracticable, particularly in view of the increase in the maximum pay of employés (½d. per hour). The lighting department has begun to reap the benefits accruing from metallic lamps; electric lighting appreciates the value of property in the city. The lighting income increased £2,259 (from £43,196), and the expenditure decreased £471 (from £28,109); the net surplus after meeting all charges was £909. During the year, 247 fresh consumers were connected, the total on March 31st, 1911, being 2,106. The department's business is stated to have been greatly restricted by the absence of powers to carry out installations on the hire-purchase system; further agitation is to be made for the granting of such powers.

**Croydon.**—The B.C. Tramways Committee on Monday proposed an increase of ½d. per hour in the maximum rates of pay of motormen, conductors, painters, and shed labourers, and ¼d. for car cleaners, the change dating from August 3rd last. The total cost was estimated at £1,633 per annum. Councillor Pelton, in moving the report, said the Committee were on the best of terms with the whole staff, and in the negotiations no threat was used to in any way hamper their judgment. Several other speakers bore testimony to the good feeling existing, one remarking that they met as man to man and friend to friend. The

proposal was unanimously carried Answering a question, Councillor Pelton said that, judged by the results of the tramways as a whole, the position of the recently re-opened Whitehorse Road route was not satisfactory.

**Doncaster—Bentley.**—The B. of T. has confirmed the Light Railway Commissioners' Order authorising the Doncaster T.C. to construct tramways to Bentley at a cost of not over £6,400. The estimated outlay is £7,600, this including £2,550 for cars and £1,400 for the electrical installation.

**Edinburgh.**—A deputation of members of the Edinburgh Tramways Committee recently visited Bradford for the purpose of inspecting the railless trolley system in operation between Laisterdyke and Dudley Hill. The visitors were accompanied by Mr. C. J. Spencer, the Bradford tramways manager.

**Glasgow.**—The T.C. on Thursday last week discussed the proposed extensions of the tramway system into suburban districts mainly, besides a memorandum as to the cost and extent of the respective new routes. This memorandum showed that the cost of the extension from Gairbraid Street to Great Western Road was, for line and equipment, £16,000; road widening, &c., £20,000; and new bridge, £10,000. South Portland Street to St. Enoch Square—Track and equipment, £22,864; new bridge, £60,000; removal of St. Enoch's Church, £15,000. University Avenue route, £7,818; Killermont to Canniesburn Toll, £7,718; to Milngavie, £45,382; Cathcart to Clarkston, £30,976; Baillieston to Coatbridge, £38,145. In some general observations on the proposals, Mr. Dalrymple said that the question as to whether lines outside the city paid, had been frequently raised, and he had found it exceedingly difficult to convince even members of his Committee that it was scarcely possible to run a service of cars on any main route from the centre of Glasgow outwards that would not pay. Experience went to prove that, speaking generally, routes which were entirely within the city limit did not yield as much per car-mile as those routes which had their termini at, say, Paisley, Cathcart, Uddingston, Bishopbriggs, &c. It really did not matter what they referred to—week-day, Saturday, Sunday or holiday—all showed the same result, that routes which were called outside routes had always the highest earnings per car-mile. From the expenditure point of view, it was not to be overlooked that the cost of operating a car outside the city was probably less than half the cost of operating the same car in the central area; in fact, it was only necessary to carry very few passengers to meet the expense of running an outside service. He had great faith in the future of outside extensions. A Glasgow tramway system entirely confined within city limits was unthinkable.

There was over four hours' discussion at the Corporation meeting, at which it was declared that no proper time had been given members to consider the scheme. It was, however, subsequently decided by majorities to proceed with the promotion of a provisional order for powers for the following extensions: Gairbraid Street to Great Western Road, and Killermont to Canniesburn Toll. The Committee is to reconsider and report on the South Portland Street to St. Enoch Square route, and it was decided not to proceed with the other projected lines.

**Ilford.**—At the last meeting of the U.D.C., Councillor Stroud, reporting on the tramway undertaking for the past year, stated that although a considerable amount had been spent in equipment, a balance out of revenue of £679 was being carried forward, which, with interest £778, made a total balance to the credit of the undertaking of £6,919. A cross-over is to be put in at the Loxford Bridge terminus, at a cost of £130.

**Leith.**—The total revenue of the Corporation tramways for the past year amounted to £31,432, as compared with £31,649 in 1910. The traffic receipts amounted to £30,570, while revenue from passengers' luggage totalled £201. The working expenses amounted to £17,789, compared with £19,150 for 1910, which leaves a credit balance of £13,642—£1,143 more than last year. The receipts per car-mile show an increase of ·07d. and expenses a decrease of ·22d. Renewal of parts of the track and overhead line will soon be necessary.

**London.**—Last week, while a steam train was being shunted at the Crystal Palace Station of the L.B. & S.C. Railway, a fireman who mounted on the cab of the engine touched a live overhead wire with his shoulder, and was thrown down to the ground, receiving bad burns and cuts on the head. The injuries, however, were not of a serious nature.

Hammersmith.—The B.C. has consented to the adoption of the overhead trolley system for the Brook Green Road, Hammersmith Broadway and Queen Street.

**Manchuria.**—It is reported from Harbin that a company is in course of formation to construct and work a system of electric tramways in the town of Dairen.

**New Zealand.**—The Christchurch (N.Z.) Electric Tramways, for the year ending March 31st, earned a profit of £2,219. According to the *Australian Mining and Engineering Review*, the gross revenue for the 12 months totalled £112,499, and operating expenses £68,037, leaving the sum of £44,460 as net earnings. Of this sum, interest and sinking fund absorbed £21,669, whilst for depreciation, fire, accident reserves and renewals, £20,572 has been set aside. The previous 12 months' profit amounted to £10,146, but during the year under review depreciation had been increased from 3 to 4 per cent.

**Oldham.**—At a meeting of the Surveyor's and Tramways Committee, the introduction of a railless trolley system for the Coppice and Moorside was discussed. The Committee is to see the system in operation.

**Tasmania.**—Launceston.—The municipal electric tramway system was officially opened on August 16th by the Mayoress. Six cars are running on two routes, a third route being in course of construction.

**Walsall.**—An extensively-signed memorial has been presented to the Tramways Committee asking for an extension of the tramways on the Walsall Wood section. The Committee for the present declines to do anything in the matter, but it has informed the memorialists that the members are closely watching the experiment of railless trolley cars, and, should the result be satisfactory, the Committee will again consider the question of extension.

The Tramways Committee has called the attention of the Electricity Committee to certain failures of supply which have occurred from time to time, causing a loss of traffic to the tramway undertaking. It is stated that since July 18th the current has failed on 12 occasions, for only two of which it was clear that the electricity department were not responsible.

**West Hartlepool.**—A Special Committee of the Corporation, which is dealing with the question of the tramways purchase, is holding frequent meetings to discuss the problems which face it. The Park and Foggy Furze routes have been subject to arbitration and litigation regarding the purchase price, and will be handed over shortly to the Corporation. The question which has to be decided is whether the Corporation shall run the tramcars on these routes, or lease the running powers if this can be done on reasonable terms. There is also the question of the advisability of purchasing the section of the tramways between the Hartlepools, which lies within the West Hartlepool borough boundaries, the lease of which will fall in shortly. There is also the Seaton Carew route to be considered. There is every probability of the Corporation having to spend a large sum of money additional to the £12,000 or £13,000 which, in accordance with the arbitrator's award, and the subsequent judgments, it was paying for the Park and Foggy Furze tramways as they stood.

## TELEGRAPH and TELEPHONE NOTES.

**Argentina.**—A concession has been granted to Antonio Grego for the installation and working of a telephone system at Macachin, in the Pampa Central district, for a term of 30 years.

**Italy.**—The high-power radiotelegraphic station at Coltano is to be inaugurated at the end of October, the King of Italy being present on the occasion.—*Rassegna di Lavori Pubblici.*

**Norway.**—The erection of the large wireless station on Spitzbergen recently decided upon by the Norwegian Storthing is being carried out with the greatest activity, so that wireless connection with Spitzbergen may be an accomplished fact before the close of the year. The installation will be on the "Telefunken" system, and the apparatus and accessories will be supplied by the Allgemeine Elektricitäts Gesellschaft, of Berlin. The two masts erected at Spitzbergen and Hammerfest respectively will be 60 m. high; the ironwork tower at the great station at Nauern, near Berlin, is 100 m. high. The new stations, as do all in Norway, belong to the State. A steamer, with building material, engineers and workmen, has already left Christiania for Spitzbergen. In view of the comparatively short time in which constructive operations are possible on Spitzbergen, the Norwegian Telegraph Department, as well as the various manufacturers, is working at high pressure. The Spitzbergen station is situated at Green Harbour, at the entrance to the Eisfjord, where a whale-fishing station is located.—*Zeitschrift für Seewesen.*

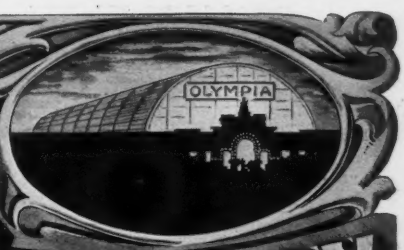
**Postal Servants.**—On Friday last week a meeting of officials of all the postal federations and associations of the United Kingdom was held at Glasgow, and passed resolutions calling upon the P.M.G. to appoint a Select Committee of the House of Commons to inquire into the alleged grievances of the postal servants.

**Wireless Telegraphy.**—Extensive wireless telegraph installations are to be erected in the Belgian Congo, covering a distance of 1,800 miles, along the course of the Congo up to Katanga.—*African Engineering.*

The G.P.O. engineers are erecting a wireless station on the roof of the telegraph department, for the purpose of experiments in wireless communication with the Continent.

**Germany.**—Hamburg.—The new Central Telephone Exchange has a capacity of about 80,000 subscribers, and is one of the largest in the world. The operating room is 132 m. × 20 m. × 9 m. high. In the exchange 112,700 relays, controlling 70,000 incandescent lamps are in use; 55,000 jack strips (1,100,000 single jacks) have been installed, 1,000,000 m. of flexible wire and a total length of 35,000,000 m. of leading wire were used, and 15,000,000 joints were made. The current for the microphones of the subscribers, for the signalling arrangements and the relays, is supplied from two accumulator batteries each having a capacity of 7,800 ampere-hours, this being sufficient for 24 hours' working of the station. The total number of telephone operators (females) is 1,500.—*Elektroteku. Tidsskrift.*

# ELECTRICAL EXHIBITION




Olympia, 1911.

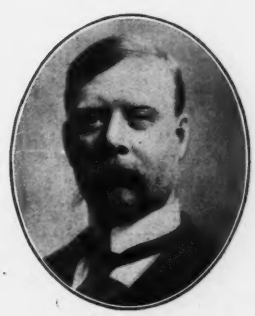
## THE PRESIDENT AND COMMITTEE.

H. W. BUTLER,
Chairman of Executive Committee.

F. B. O. HAWES, A.M.I.C.E., A.I E.E.
Secretary to the Exhibition.

Sir W. H. PREECE, K.C.B., F.R.S., M.I.E.E., &c.
*President of the Exhibition.*

H. L. BENJAMIN,
Organizing Manager.



T. E. GATEHOUSE,
F.R.S.E., A.M.I.C.E., M I.E.E.

F. J. WALKER.

A. C. CRAMB.
M.I.E.E., M.I.Mech.E.

Photographs.

| | | |
|---|---|---|
| Sir W. Preece | by | *Elliott & Fry.* |
| H. W. Butler | ,, | *Langfier.* |
| F. B. O. Hawes | ,, | *Mendelssohn.* |
| H. L. Benjamin | ,, | *Lambert Weston.* |
| F. J. Walker | ,, | *Elliott & Fry.* |

A. T. SNELL, M.Inst.C.E., M.I.E.E.,
Consulting Engineer.

S. G. C. RUSSELL, M.I.E.E.,
Consulting Engineer.

Photographs.

| | | |
|---|---|---|
| A. C. Cramb | by | *Bender & Lewis.* |
| A. T. Snell | ,, | *Arthur Weston.* |
| S. G. C. Russell | ,, | *Elliott & Fry.* |
| T. E. Gatehouse | ,, | *Turner & Drinkwater.* |

# EXHIBITION NOTES AND COMMENTS.

**The Objects of the Exhibition.**

To-MORROW at 2 o'clock, after a formal ceremony performed by Sir Wm. Preece, the Electrical Exhibition doors will be thrown open to the public. To-night, in celebration of this auspicious occasion, the committee, exhibitors, and some others interested in the progress of electricity are holding an inaugural banquet at the Trocadero Restaurant, under the chairmanship of Sir W. H. Preece, K.C.B., F.R.S., the president of the Exhibition. While some principals and managers or heads of departments are thus fraternising at the "Troc." engendering the right spirit of friendliness and co-operation which, while not eliminating legitimate rivalry, will perhaps help to keep competitive rage within more reasonable bounds, their representatives will be quite equally profitably engaged in the hall and gallery of Olympia, putting finishing touches to the 240 exhibits, so as to make a strong and lasting impression upon the public mind. Here we have named two great ends that this Exhibition is intended to serve—a greater intimacy between those directly interested in electrical industry, and a better understanding of electricity and the variety and usefulness of its applications by the public, that great body of individuals who through public departments, contractors, or "on their own," are the purchasers of many of the lines of manufacture shown. We hope that both of these objects will be furthered in the course of these four weeks of exhibition activity. But there is a danger that we may regard this event too much from the point of view of those who desire to give a "boost" to electricity among the populace. From the list of exhibitors published on a following page, as well as from our knowledge of the character of the exhibits, we are convinced that the Exhibition will be one of great interest to electric light and power station engineers—designers as well as operators—in all parts of the kingdom, and to engineers of all classes who are interested in the hundreds of steam and electrical appliances that are offered to assist them in their striving after efficiency, economy, and general satisfaction. It is not to the public and the electrical engineer alone that this Exhibition is of use. The engineer, as an engineer, cannot fail to find awaiting him education and instruction, which at other times he could only obtain by the expenditure of much time and money. Here many manufacturers and their representatives are present expressly for the purpose of imparting information to such men, and we hope that they will be besieged with questions. Maybe they will develop such a talking ability that the closing functions of October 21st will bear evidence of their progress in a direction where some people think that the English race is a trifle deficient.

**The "E.R." and the Exhibition.**

As for the ELECTRICAL REVIEW and its part in this matter, we have taken our stand (No. 227) opposite the main gangway at the further end of the Hall, where we shall be pleased to see our friends. But beyond this, it is our intention, as a journal, to follow fairly closely the lines adopted by us on the occasion of the Manchester Electrical Exhibition. What we did then led to so general a chorus of approval, that we prefer to do very much the same again rather than to indulge in sensational departures which may not in the end be altogether satisfactory.

We are, with the aid of exhibitors, preparing descriptions of all the exhibits that we regard as meriting attention. A first instalment of these appears in the following pages, and notices of the remainder will be spread over the next four issues. Electrical journalism in London, unfortunately, is still not altogether free from the *quid pro quo* "understanding" in connection with editorial descriptions and advertising. It is a reprehensible practice, as we have said before, and only serves to bolster up papers which, without it, might not be able to exist. It would be a good thing if the trade as a body would set its face against the practice right at the very beginning of this Exhibition, so that the reputation of the electrical press may not be again sullied by a repetition of those miserable acts which were the subject of conversation on many sides at Manchester. A Press which has to go whining after manufacturers is not a good thing for any branch of industry. The electrical manufacturers' interests will be best protected when their trade organs are able to speak fairly, independently, and without fear, and are at liberty to describe any new manufacture or development that is likely to interest the reader.

**The Foreign Reader and the Exhibits.**

Interest in an Exhibition of this character is not confined to this country. The reader in the Colonies, and electrical men stationed in some of the most out-of-the-way quarters of the globe, will peruse our pages with additional interest during the next few weeks in search of knowledge regarding the latest productions of British manufacturers. Appreciating what this means, we have supplemented our usual arrangements whereunder the REVIEW is already available at many a Consular station or Commercial Attaché's department, and our description of the exhibits of 1911 will reach the hands of an army of electrical engineers and electrical buyers who cannot come from 100 to 12,000 miles across the seas to see the manufactures themselves, but are prospective purchasers whom the British manufacturer is anxious to reach. We trust that this will redound to the benefit of the whole industry, for a collection of descriptions of leading manufactures of a hundred or two firms is of no little value and will not be lightly cast aside.

**Timely Counsel from Authorities.**

In addition to our photographs of the Executive Committee and officers, which, under the auspices of the National Electrical Manufacturers' Association, has been responsible for the work of organising this Exhibition, we publish to-day messages which are of timely interest from three well-known gentlemen. Mr. H. W. Butler, the chairman of the Executive, strikes the right note in urging us all to put our shoulders to the Exhibition wheel. Mr. Frank Bailey, one of London's greatest and oldest-known authorities on electricity supply, expresses many feelings which will be uppermost in the supply engineers' minds at such a moment, and Mr. G. Harland Bowden, the at once aggressive and diplomatic second-year chairman of the Electrical Contractors' Association, reminds us all of some things that are wrong, and offers sentiments which every section will do well to consider and talk about during the coming weeks when they are rubbing shoulders at Olympia.

**Learning from Experience.**

When the first Electrical Exhibition at Olympia was held in 1905, the electrical industry had not any large accumulation of experience of the organisation of exhibitions to guide it. Though, as some will remember, things in the main passed off with excellent success, there were some features which led to a little dissatisfaction, and not a little friction. But we know better now. Manchester, though a remarkable success in 1908, also had features which did not give universal satisfaction. Again, we know better now. And though it may still be that everything will not run to the perfect pleasing of everybody—we wonder whether there ever was an exhibition in this world in which it did?—our knowledge of past mistakes should assist to secure for the present Exhibition a larger measure of approval for what has been done for exhibitors' convenience than at either of its predecessors. If any reader chooses to compare the *personnel* of 1911 with that of 1908, he will find that at least eight of the committeemen are the same. The secretary is not the same, but Mr. F. B. O. Hawes was "in the thick" of the fight at Olympia in 1905, and he has for many years been in the inner counsels of the Electrical Manufacturers' Association. As this year's secretary he has been labouring unceasingly to secure a success. Everybody will agree that he is a gentleman of unfailing courtesy. The organising managers are the same as came to the assistance of the electrical industry at an important stage at Manchester in 1908, and what Mr. H. L. Benjamin and his staff do not know about exhibition arrangements—well, it is hardly worth the knowing. So far as we can see, barring accidents, everything augurs well for a good time for everybody, provided the right classes of the industrial and general community are by generous ticket distribution, and by attractive and timely

advertisement, induced to turn their steps or motors in the direction of Olympia.

**Stand Attendants! A Word with You.**

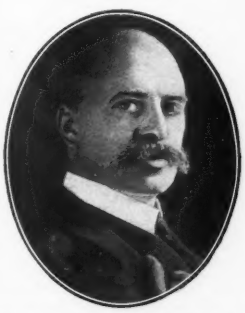
We have visited scores of engineering, electrical and industrial exhibitions, and *the* thing which, above all others, has left a very definite impress upon our minds is the important part which the stand attendant has to fill on such occasions. It may be that the reader of these notes is the master of his own business, and he is putting his right foot forward and representing himself in order to build up a future connection; he may be a manager of a large and well-known electrical organisation, who will have with him at this Exhibition a score of faithful assistants doing his will; it may be a commissionaire, a young lady attendant or a lad who at times is left in charge. Each of these in his or her own way can do much to make or mar the Exhibition. We might write pages of counsel on what to do and what not to do so as to secure the best results, but we will refrain. We have written much of this kind of thing on other occasions. A business-like Exhibition which is to do good business, demands of everybody his best. Courteous and intelligent talk, the assiduous attention and the amiable manner, the knowledge when to smoke and drink and when not to do so, these ought by this time to be understood as essentials in the efficient attendant. There is a proper time for everything, as said that old-time sage who carried the burden and privilege of a thousand wives. Let us all, then, give one, long, continuous, determined pull all together for the next month and so confer a lasting good upon all departments of the electrical industry.

H. H. Berry, M.I.E.E.

H. Bevis, M.I.E.E.

T. J. Grainger, A.I.E.E.

D. N. Dunlop.



W. M. Mordey, M.Inst.C.E., P.P.Inst.E.E.

B. Longbottom, M.I.E.E.

P. A. Lundberg.

F. H. Nalder, M.I.E.E.

H. Oppenheimer, A.I.E.E.

S. D. White.

H. C. Siddeley, A.I.E.E.

W. R. Rawlings, A.M.I.E.E.

Photographs.—H. H. Berry, by *Rodway Gardner*; H. Bevis, *Lafayette*; T. J. Grainger, *Lafayette*; W. M. Mordey, *O. & K. Edis*; P. A. Lundberg, *Miles and Kay*; F. H. Nalder, *Wayland*; H. Oppenheimer, *Stereoscopic Co.*; S. D. White, *Arthur Weston*; W. R. Rawlings, *Webster & Son*; H. C. Siddeley, *Lomnitz*.

## ON MAKING THE EXHIBITION A SUCCESS.

By H. W. BUTLER

*(Chairman of the Executive Committee).*

In a few hours the Electrical Exhibition of 1911 will have opened its doors and become an accomplished fact. All the labours of organisation and detail which have occupied the Committee and management for over a year are now finished; everything possible in the way of ensuring the comfort, convenience, and welfare of both exhibitors and public, has been thought out and carried into effect—in short, all that is possible has been done by the organisers with the material at their disposal to ensure the success of the Exhibition. It now only remains for the exhibitors to take full advantage of all that has been prepared for them, and thus to put the finishing touch towards making the event that huge success which it not only promises but deserves to be. Let the right spirit actuate everyone concerned, from the principal to the stall attendant, let there be only one quality of exhibit so that there can be none better, and let every step be taken to get the right public to visit the show, and I have no hesitation in saying that the impetus given to all branches of the trade will be felt not only in the immediate future, but for months and years after the Exhibition has closed its doors.

Let exhibitors see to it that their exhibit is never left unattended, but is always in charge of some competent individual who, by his clear and persuasive explanations, will be able to sow the seeds of future business even if he is not able to effect a "deal" on the spot.

As regards the public, the magic charm of electricity is such that the interest it creates will be sufficient to fill the show, but still it is very important that steps be taken to get the right people, and this is where not only the exhibitors, but the electric supply authorities and the contractors, can render great assistance; an assistance which, while helping towards the success of the Exhibition, will even in a greater degree benefit themselves. Let exhibitors and contractors ensure that every likely customer is pressed to make at least one visit; let the supply authorities and companies supplying London and its immediate neighbourhood send all their consumers, or would-be consumers, to see the special displays in electric cooking, heating, lighting and motive power; and let the engineer of every supply authority and company in the United Kingdom so contrive that his committees or directors and their most important customers, at least, are enabled and persuaded to see all the latest developments.

Only when every one has followed out these suggestions will it be possible to say that the labours of the Committee and management have been made use of to the fullest extent, or in a manner that we are entitled to expect.

In conclusion, if I may say a few words to the exhibitors in general, it would be to suggest that they utilise any spare time they may have during the show to become better acquainted and more friendly with their competitors. I have been in the trade now over 30 years, and the longer I am in it the more I feel that the great thing wanted is for its members to know each other better, and to foster greater co-operation amongst themselves.

Remember, too, that the Exhibition was conceived, organised and carried through by the N.E.M.A.—or, as it is now called, the British Electrical and Allied Manufacturers' Association—an association which enables you to become better acquainted with your competitors, and which is already doing good work. If properly supported, there is no limit to the sphere of usefulness of such an association to the trade as a whole; and, if you are not already a member, ask yourself whether it is good policy, or even good business, to remain outside, when by doing so you are certainly weakening its power for good.

## THE EXHIBITION AND ELECTRICAL SUPPLY.

By FRANK BAILEY, M.Inst.C.E.

*(Joint Managing Director of the City of London Electric Lighting Co., Ltd.; Director of the Metropolitan Electric Supply Co., Ltd.).*

THE utility and commercial success of exhibitions have been frequently discussed, and, perhaps, too frequently it has been necessary to supplement the efforts of exhibitors by including side-shows of weird and ingenious contrivances capable of producing every motion which can cause bodily inconvenience to the daring visitor. The Electrical Exhibition, which will be opened to-morrow, will require neither joy-wheels nor wiggle-woggles to attract paying guests during the four weeks it will occupy the large space at Olympia. The promoters have secured the support of all manufacturers and suppliers of electrical appliances, and a friendly rivalry in excellence should interest, not only those who wish to procure the best fittings and appliances, but also those who wish to see what can be done with an electrical supply.

The growth of the electrical industry since the last Exhibition in 1905, in all matters relating to supply of energy, provides convincing evidence that a progressive demand will continue to call for all the goods which will be displayed. The connections to the mains of the various supply authorities in London and the provinces have increased from about 1,000,000 KW. in 1905, to 1,500,000 KW. at the end of 1910, this growth being all the more remarkable when it is remembered that the lighting value of a kilowatt in glow lamps has increased from 250 C.P. to 1,000 C.P.

Domestic electrical illumination is now so cheap that the natural desire for more light is easily gratified. The Exhibition will doubtless provide all the necessary illustrations to assist those who wish to obtain the best results at the least cost, enable the present user to obtain improved results, and convince the doubtful light-seeker that the modern glow lamp can bring artistic brightness into every home.

Electrical fittings have not hitherto been universally accepted as works of art, but with the past experience of 25 years to guide and attract the attention of artistic designers, we may reasonably expect that the merits of the lamp, and freedom from limitations caused by considerations of weight and fumes, will tempt a departure from the Spartan severity of the gas bracket.

Many of the supply authorities in London and the provinces have realised the commercial benefit of maintaining showrooms equipped with illustrations of electrical apparatus of interest to their consumers, and the assembly of the best examples of all fittings at this Exhibition will enable them to take this opportunity of improving the display at these local showrooms.

All users of electric light are now anxious to secure relief from the glare of the metal-filament lamp; and as considerable progress has been made in the various forms of globes and shades to secure diffusion and even distribution of illumination, the Exhibition will be of great value in showing the public that a soft and subdued light can now be obtained.

While all consumers are interested in lamps and fittings, there are still many people who are anxious to ascertain what appliances they can obtain for domestic use in order to reduce the difficulties of the present-day servant problem. We are now accustomed to be told that in America they have overcome all necessity for employing Mary Ann, as electrical supply works the vacuum cleaner, cooks the meals, irons the linen, cleans the knives, and blacks—or browns—the boots. At Olympia we shall see all these appliances in successful operation.

The vacuum cleaner, originally patented in 1883, has had a long period of development, and although in its modern form it has not departed much from the original, it is considerably improved in detail; there is now no necessity to provide a large apparatus in the basement, or to run piping all over the house, with the consequent possibility of blocking the pipe with matches or other material. Many forms of apparatus will be on view at the Exhibition, which will convince the most sceptical that they are not only portable but also practically noiseless in operation.

As regards cooking, it is perhaps easier to show the apparatus at work than to give convincing proof that it will stand the test of time. The importance of this domestic application will appeal to all users; and as the cooking range does not now consist of only the one much-abused vessel which was formerly offered as a satisfactory means of performing all culinary operations, and could boil, fry, roast, or act as a cigar-lighter by simply turning the switch, it has a fair chance of becoming indispensable to every modern house, and will doubtless be offered for sale with a guarantee for reliability and long life.

The electric iron, and other laundry fittings, will tempt many householders to have their lighter laundry work done at home.

With this brief survey of matters which may interest most of the visitors to the Exhibition, we must now realise that it is not easy for the ordinary visitor to see everything without trouble, or to witness an actual demonstration of every appliance. The supply companies of London have, therefore, arranged to assist both exhibitors and visitors. For this purpose a large space has been allotted to them, and the Conference of Chief Officials of the London Electric Supply Companies are once more indebted to their Honorary Secretary, Mr. F. J. Walker, the Manager and Secretary of the St. James' and Pall Mall Electric Light Co., Ltd., for arranging for a special pavilion where all information relating to public electrical supply can be obtained; and in addition, a suitable space has been prepared for the purpose of giving public demonstrations of the use of vacuum

cleaners, cooking appliances, ironing, &c. In this good work all the London Electric Supply Companies are joining, and Mr. C. Stanley Peach, F.R.I.B.A., has kindly prepared the plans for this unique part of the Exhibition.

All supply authorities have been much indebted to manufacturers of appliances, and to the trade generally, for their assistance in furthering the interests of the industry, and by offering facilities for public displays, it is hoped that the supply companies will not only benefit themselves but also assist those who have any apparatus to sell. By issuing invitations to their customers the supply companies will be able to secure a large attendance and to arrange for the display of the domestic appliances of most interest to their consumers. Representatives selected from the supply companies will be in constant attendance, and will be able to satisfy any inquiry as to supply; they will also be ready to take visitors round the Exhibition, and do everything except pay for the goods which we are confident the visitor will wish to obtain.

## THE EXHIBITION AND THE INDUSTRY.

BY G. HARLAND BOWDEN, M.I.M.E.
*(President of the Electrical Contractors' Association.)*

ALL interested in the consumption of electrical energy are grateful to the promoters of this Exhibition for their untiring and strenuous efforts in organising the Exhibition, and for the opportunity thus afforded to all concerned to inspect the various manufactures associated with the supply and consumption of electrical energy, gathered together under one roof.

The Exhibition is, perhaps, more interesting to the general public than to any of the commercial interests associated with the enterprise. The use of electricity for domestic purposes is becoming a matter of everyday necessity. Too often we allow to pass unchallenged the statement that electricity in the home is a luxury. I once heard a reverend gentleman in an out-of-the-way parish in the West of England state that he would sooner live in a small cottage lighted by electricity than live in a mansion illuminated by any other means; and this is a general experience. Any individual who has once experienced the convenience and cleanliness of electric lighting, and who may change his place of residence, is always prepared, at considerable sacrifice, to obtain electric light again, if, unfortunately, his new locality be in a district where current is not readily available. The same remarks apply to the numerous details in which electricity now plays an important part in our home life, and in our industrial life. Therefore, the public are chiefly interested in this Exhibition, and time will be well spent in examining the various exhibits, and in scheming how the devices shown can best be applied for greater convenience and economy at home. I can imagine a member of the British public visiting this Exhibition. He looks round and sees proof of enterprise, and naturally arrives at the conclusion, as will a great number of his fellows, that the paths of those commercially interested in the increased consumption of electrical energy, are happily laid, and that the Exhibition, proving, as it does, an education to the public in the general utility of current consuming devices, will develop and increase the demand for electricity and electrical apparatus.

Here are assembled for the benefit of the public, in tempting form, every detail that the consumer may require. The visitor referred to is interested; he is ready to listen and to receive instruction, and he says, or thinks, "This Exhibition shows me exactly what I require. How can I arrange about my installation?"

It seems quite simple. In the first place there are:—(A) Supply authorities, ready to supply current day and night; (B) Manufacturers whose whole energy and enterprise have for years been devoted to perfecting the numerous devices which we can use in our homes for lighting, cooking, heating, &c.; (C) In every town throughout Great Britain, skilled contractors ready to wire premises, and to install at reasonable terms all those details, and to carry out the work to the satisfaction of the supply authorities, and in strict accordance with Fire Office Rules, and other regulations and by-laws.

The public are, therefore, justified in imagining that at Olympia the various interests of the manufacturer, the contractor, and the supply authorities are collected in harmony, showing a combined and friendly coalition for the welfare of the trade generally, so that without any hitch or delay the consumer can be promptly given all the necessary attention by skilled representatives of the various interests thus organised. Such a combination should look forward with confidence to success, the aim and object being to increase the use and consumption of electrical energy. As business men A, B and C realise that such increase can only be brought about by the consumer feeling that he is receiving the very best advice and attention. The consumer is satisfied when he finds A, B and C each attending to their own departments, and combining to give prompt and careful attention to his requirements. I repeat that any member of the public is justified in looking round this Exhibition and assuming that these various interests of A, B and C are working together for the common good and for the public benefit towards the desired end.

There is, however, a skeleton in the cupboard. The manufacturer, by whose enterprise the Exhibition is made possible, sees his turnover sadly affected by the opposing interests and the absurd position created between the supply authorities and the contractor. The municipal supply authorities, instead of encouraging the manufacturer and the contractor, are desirous of taking over the whole of the installation work for their consumers from the manufacturer and contractor. Hence, the contractor, who is admittedly the best canvasser for the supply authorities, not knowing at which point he is going to be assailed, fears to risk further capital in developing what may become another's business. The position throughout the country is not such as one would imagine after a visit to this Exhibition. The manufacturers, with very few exceptions, endeavour to carry out their obligations to their friends and the contractors, and try honestly to protect the trade interests by maintaining the usual trade terms and discounts. The number of contractors is slowly diminishing because of the unfair competition of the municipal engineer. Hence the manufacturers' sales are not what they should be. On the other hand, should the municipal electrical engineers have their way, the manufacturers will be at the mercy of an individual or individuals who will be at once current supply authorities, consulting engineers, contractors and merchants, with power to carry out the work and pass it afterwards, or refuse to pass the various fittings as their autocratic will may be pleased to decide, or in the event of a flaw in the installation over which the manufacturer has no control. Under such threatened conditions, can the manufacturer feel that his wares will be given a fair chance, or that the public will receive fair encouragement to make their own selection of cooking or heating apparatus or fittings, decorative or otherwise? I do not think that the experience which the general public has had with officials of municipalities will lead them to believe that they will receive the ordinary treatment of a customer who desires, at least, to have some say as to how his money shall be spent. From the point of view of increasing the demand for electricity, the supply authorities cannot hope that, even with all their energies devoted to the task, the results would compare with what could be accomplished by the whole trade unhampered by strife and aggressive action on the part of one towards the other.

The Exhibition fairly demonstrates immense possibilities for good, but under the surface lies this evil which is doing incalculable harm to all interested in the supply and in the manufacture and installation of electricity and current consuming devices connected therewith. It is necessary that the eyes of all concerned, including those of the consumers, should be opened to the position of affairs, and the ideal conditions which one might imagine existed at an Exhibition such as this should be the aim and object of all interested parties, in order that the increased trade hoped for by those who have been enterprising enough to bring about this Exhibition may be successfully attained, and in order that the great commercial interests and the firms involved shall not be reduced to mere ciphers in the insane competition with local gas companies, which, regardless of the welfare of the electrical trade generally, appears to be the main object of the municipal electrical authorities.

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# SOME OF THE EXHIBITS AT OLYMPIA.—I.

**(The figures in parentheses are the numbers of the stands.)**

### Crypto Electrical Co. (57),
*Bermondsey Street, S.E.*

The machines shown by this firm include a petrol-driven dynamo set designed for lighting country houses, which they are now supplying, with outputs from 250 watts up to large sizes; and a line of alternating to continuous-current transformers suitable for lighting cinematograph arc lamps, charging accumulators, or actuating the switchgear, &c., on an alternating-current lift, and so on. We illustrate the 350-watt size. Another feature on the Crypto stand is a D.C. to D.C. rotary transformer, which has been

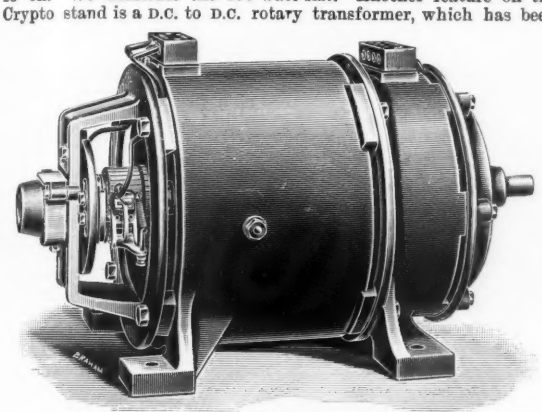


FIG. 1.—CRYPTO A.C.—D-C. TRANSFORMER.

designed to reduce from high-voltage mains to low voltage for cinematograph arc lamps. It is of the double wound type, fitted with a commutator at each end. The machines which are made at the Bermondsey factory can be wound on the motor side for any voltage up to 530 volts.

Finally, mention may be made of a line of standard pattern alternating-current motors, both slip-ring and squirrel-cage rotor type, and a line of continuous-current motors and dynamos.

### Messrs. E. Brook, Ltd. (245),
*Colne Road, Huddersfield.*

A number of single, two and three-phase motors wound for voltages ranging from 50 to 500, and frequencies from 25 to 100 are exhibited by this firm, who, as our readers know, specialise in this class of work. Slip-ring motors, motors fitted with back gear, porthole fans, motors and dynamos combined for charging accumulators are in evidence. Particular attention may be drawn to their back-geared motors, which consist of the ordinary motor

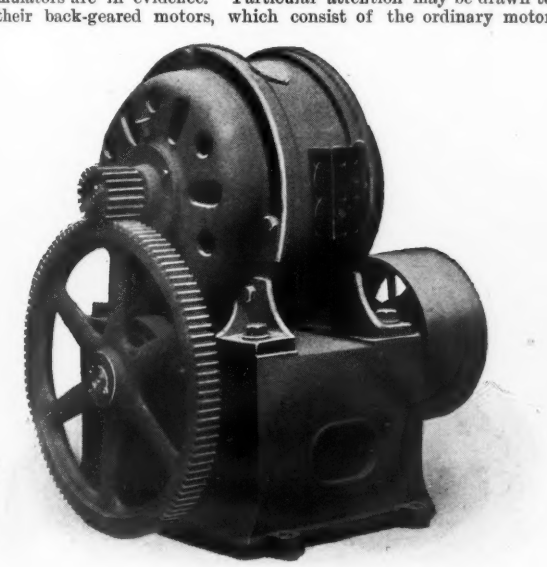


FIG. 2.—BROOK BACK-GEARED MOTOR.

mounted on a special box type casting fitted with a reduction gear ratio, 6 to 1 (fig 2). These castings are fitted with ball-bearings throughout, and by making them up in large quantities the firm can take any stock motor and fit it on to these gears within two hours, so that delivery can be effected the same day as ordered. Another speciality is Messrs. Brook's small motors of ½ H.P. for driving looms. These are made for single and three-phase, are totally enclosed and fitted with ball-bearings, and have a special cradle to allow for the belt always being kept at the correct tension.

### J. Rhodes & Sons, Ltd. (14, 47),
*Grove Ironworks, Wakefield.*

This exhibit consists of two of the power presses in which the firm has specialised. In fig. 3 we illustrate their latest model inclinable press (No. 19) in upright position, with electric motor fitted for driving it. Their No. 21 power press, which is not shown running, has been specially designed for stamping the tops and bottoms of petroleum cans. The efficiency of the Rhodes presses is due to the fact that the centre of the crank, the centre of the slide, and the centre of the hole in the slide, are all in one straight line. The ejector is in front of the slide and is adjusted by a single screw. The coupling is of steel, with gun-metal bearing. The machines are fitted with all the latest improvements, such as Messrs. Rhodes's new patent safety clutch motion, patent ejector in the ram, and other features which enabled the presses to take the Grand Prix at the Brussels Exhibition of 1910. The press illustrated is fitted with automatic double roll feed adjustable for operating dies varying in thickness. The rollers can be instantly swivelled out of the way of the operative for setting.

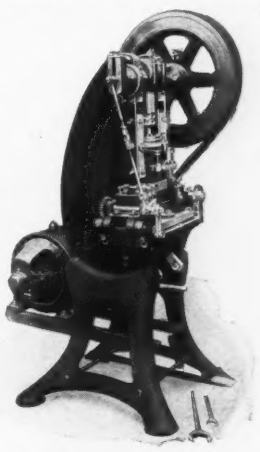


FIG. 3.—RHODES INCLINABLE PRESS.

### The Aster Engineering Co., Ltd. (243),
*Wembley, Middlesex.*

Quite an imposing collection of generating sets is exhibited by this firm, including no fewer than eight high-speed vertical engines running on either petrol or paraffin, and, in most cases, directly coupled to dynamos. These range from 2 to 30 H.P. in output, and one of them, a 14-H.P. twin-cylinder set running on paraffin, is used for lighting the stand. We have selected for illustration a four-cylinder 18-H.P. set running on petrol; the cylinders are 95 mm. bore, 140 mm. stroke, with mechanically operated valves, and Bosch high-tension magneto ignition, driven by enclosed oil-fed gears. An enclosed centrifugal governor controls the throttle. The bearings are of bronze, lined with white metal, and lubricated

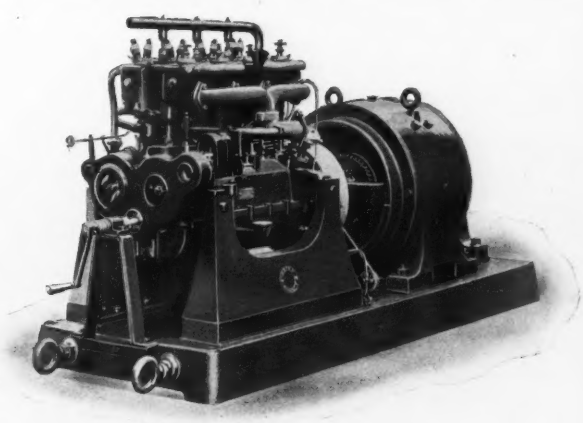


FIG. 4.—ASTER 18-H.P. GENERATING SET.

under pressure with oil supplied by a gear pump drawing from the base of the engine; the big ends of the connecting rods are similarly lubricated through the drilled crankshaft. The engine is mounted on a substantial cast-iron bedplate, and is coupled by means of the Aster flexible coupling to the generator, which was made by Messrs. Siemens Bros., and has an output of 12 KW. at 1,000 R.P.M. The engine can be adapted for paraffin by fitting it with a different carburetter and slightly modifying the piping.

We understand that the Aster Engineering Co. claim to be the largest high-speed vertical engine builders in Europe, there being over 17,000 of their engines at present in use.

### Reavell & Co., Ltd. (232),
*Ranelagh Works, Ipswich.*

At the farther end of the hall (right hand corner) Messrs. Reavell and Co. have an interesting collection of their manufactures con-

taining examples of their air compressors, oil engines and steam engines. Their patent quadruplex compressor is represented by one of the smaller-sized machines of 45 c.f. capacity, belt driven. As most of our readers are aware, the principal feature of this compressor is the fact that it has four single-acting cylinders in which the air is compressed, these cylinders being arranged radially in an annular casing, which forms a water jacket, through which all the cylinders pass. The effect of this is to ensure very efficient cooling of the air during compression, and a consequently low power consumption. All the connecting rods work on a single crankpin, and air is admitted to the cylinders through ports in the connecting rod gudgeons, which are hollow, and similar ports in the pistons which are opened and closed by the axial motion of the gudgeons. This entirely eliminates suction valves and ensures a gain in volumetric efficiency of at least 5 per cent. as compared with compressors having spring-loaded suction valves. The four cylinders result in a very even turning moment, and make the machine very suitable for electric driving. The arrangement also renders the machine very easy to dismantle, it being possible to take out all the cylinders, pistons, &c., in the space of a few seconds by simply removing a single tap-bolt fixed in the crankpin.

The firm are also showing a compressor of the new type which they have designed, and which they have named their "Axial"

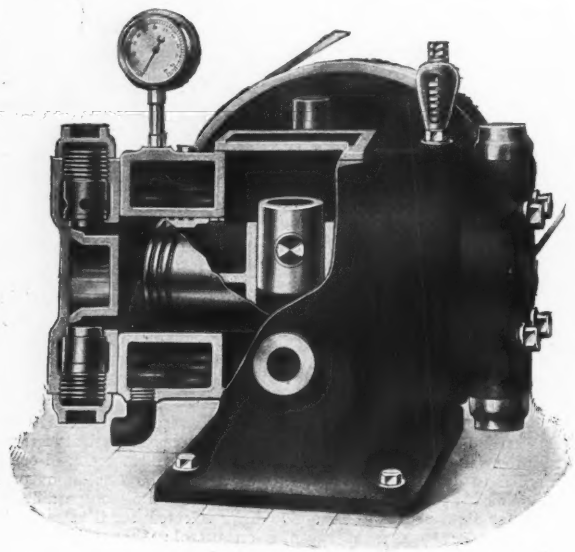


Fig. 5.—Reavell "Axial" Compressor.

compressor. The construction of this machine will be clear from the illustration given in fig. 5, which shows the compressor partly in section. There are only three working parts—the piston, the crosshead, and the crankshaft. The crankshaft has a crankpin formed upon it, which projects into the crosshead, and a hole is bored in the piston to take the latter, which slides up and down as the crankshaft rotates, moving the pistons backwards and forwards. This compressor is very compact and simple, and the price in consequence is moderate.

Messrs. Reavell's portable "sub-station compressor" is shown, which is so arranged that it can easily be carried by two men, and one of the firm's vertical high-speed oil engines is exhibited, directly coupled to a dynamo. A very large number of these oil engines have been sold for electric light and power generating sets for country houses, and they are also very suitable for driving centrifugal pumps and other machinery. They can be very easily arranged for belt driving by fitting a pulley. Lubrication is on the "splash" principle, and is, therefore, automatic, enabling the engines to be left running for long periods without attention. One of the firm's small high-speed steam engines, directly coupled to a dynamo, is also shown. This engine is of the vertical enclosed type. Lubrication here is also on the "splash" principle.

### Aerators, Ltd. (77),

*Craig's Court House, Charing Cross, S.W.*

This firm exhibits a line of fire extinctcurs charged with carbon dioxide in liquid form, sealed up in steel cylinders, which discharge from 2 to 2½ gallons of water at a practically constant pressure, and a smaller type to take the place of hand-grenades. The "Prana" non-rusting plaited metallic hose-covering is another interesting feature, being extremely flexible and yet very strong. The wire used is not only galvanised, but also double-tinned to prevent rusting, and the closeness of the plaiting confers great strength upon a hose protected with this covering. It might be applied with advantage to the armouring of flexible cables. Fig. 6 shows the double-plait type of covering.

The company are also manufacturers of die-finished castings, of which one is illustrated in fig. 7, showing slots and grooves cast in; screw-threads above $\frac{5}{16}$ in. Whitworth can be cast, and the saving of machining greatly reduces the cost of the parts. The system is particularly useful in the manufacture of many types of electrical

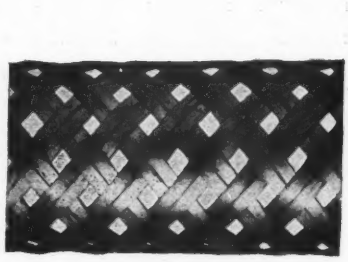


Fig. 6.—"Duplatt" Hose Covering.

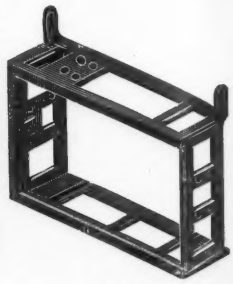


Fig. 7.—"Prana" Die-Finished Casting.

apparatus requiring great accuracy of fitting. A special "Prana" alloy is used, in various grades, which incidentally is an excellent metal for bearings.

### "Auto" Recorder Co. (228),

*Kent Street Works, Leicester.*

This company is exhibiting a "Midland" patent controlled draught furnace, a complete apparatus being shown ready to lay in a boiler flue. It is also fully showing its "Auto" $CO_2$ recorder for the automatic and continuous analysis of boiler flue gases, which we illustrate in fig. 8. Two of these instruments will be in operation, and a third will also be at work, but with its outer case removed and with a glass central water vessel so that the working can be plainly seen. Yet another of these instruments will be present, but entirely taken to pieces, so that the visitor may fully understand the details of the inner construction. This instrument is being used in a large number of works; for instance, one Lancashire combine has 28, a Colonial firm has purchased 40, and a Continental firm has taken 19. In the Auto Co.'s own works it has paid to give the stokers a bonus according to the excellence of the chart, and in many up-to-date works this practice is followed. Every few minutes the instrument analyses a sample of the gases passing to the chimney from the furnace, and records on the chart the percentage of $CO_2$ contained therein. The recorder is fixed near to the boiler, a ½-in. pipe running from the flue to the instrument, and the "Auto" patent filter supplied is placed in the pipe near the boiler flue to remove the dust and keep the pipe from choking. Only a small water supply to work the recorder is required,

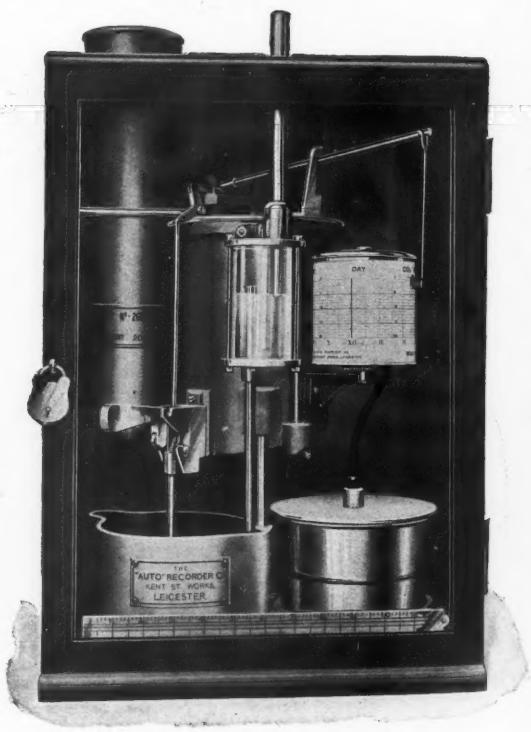



Fig. 8.—The "Auto" $CO_2$ Recorder.

capable of delivering a few gallons an hour, also a drain from the recorder. The latter is started by a simple operation, and thereafter its action is automatic. Two or three minutes daily to change the chart, cleansing of the filter, taking two minutes, about twice a week, and a changing of the caustic solution about every two to four weeks—these represent all the attention that is required. The size of the "A" model is 15 in. × 12½ in. × 21 in., and its weight in an all-metal case is 120 lb.

**Electromotors, Ltd.** (126, 133),

*Openshaw, Manchester.*

This firm's name has become one of the household words of the electrical industry, especially in recent years. It has secured for itself at home an excellent reputation and abroad a fine connection, which is another way of saying the same thing, for its dynamo and

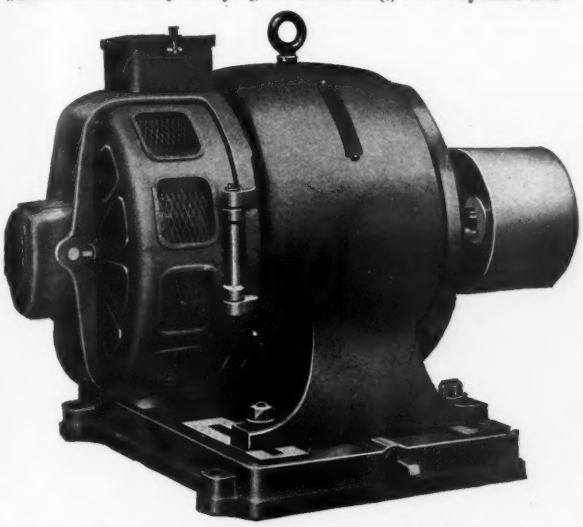


Fig. 9.—Standard Enclosed Ventilated Type Motor.

motor specialities, and its work in connection with factory and works electrification. Its stand is in a prominent position in the central gangway, not many steps from the main entrance to the

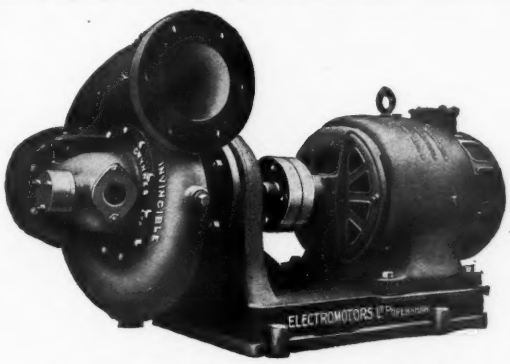



Fig. 10.—Motor-Driven Centrifugal Pump.

Hall. The exhibit includes a few representative sizes of a specialised range of continuous-current motors, and demonstrates their application to the driving of various types of machinery.

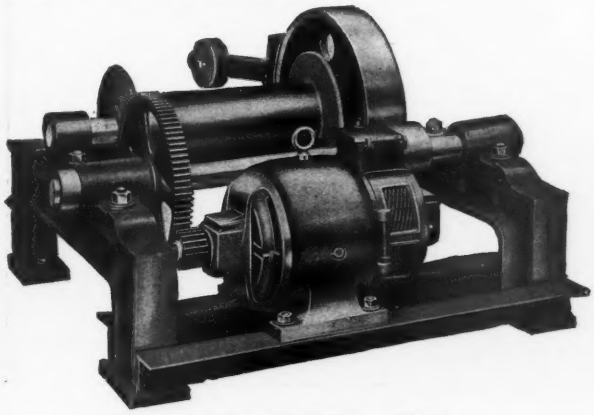


Fig. 11.—Electrical Friction Hoist.

Enclosed ventilated type motors of 1, 5, 10, 20 and 30-H.P. sizes are to be seen, and there is also a 20-H.P. 850-R.P.M. pipe-ventilated motor with weather-proof cowl, mounted on a standard box-bed type spur reduction gear, having machine-cut double helical wheels and self-lubricating bearings for the second-motion shaft. A small steam dynamo suitable for ship lighting, capable of giving an output of 4 KW. at 550 R.P.M., is exhibited (see fig. 12). The engine is of the single-cylinder vertical double-acting open-fronted type with shaft governor. Another feature is a small single ram pump suitable for country houses and small installations generally, capable of dealing with 250 gallons of water per hour, against a total head from all causes of 100 ft. In conjunction with this apparatus is an automatic float equipment, starting and stopping the pump according to the amount of water in the tank, and a special tank to show this in operation is provided.

A 17½-in. electrically-driven fan is shown, the motor being of the shunt-wound totally enclosed pattern, easily capable of driving the

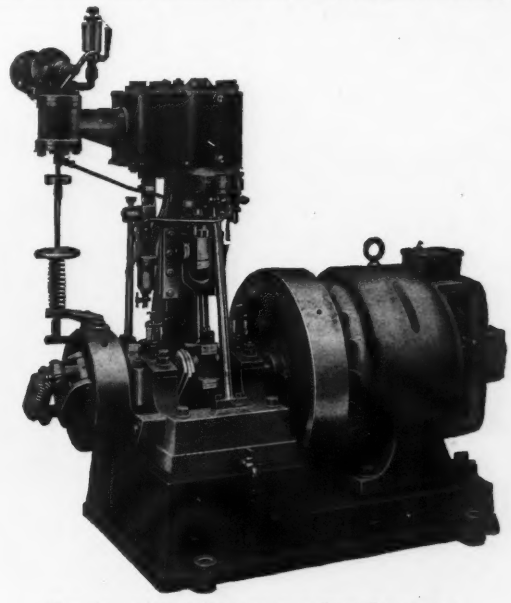


Fig. 12.—Steam Dynamo for Ship Lighting.

fan on open intake and discharge. The fan is suitable for dealing with 9,000 cb. ft. of air per minute under these conditions. There will also be observed (fig. 10) a 3-H.P. enclosed ventilated motor direct-coupled on a combined bed to a 3-in. centrifugal pump, capable of dealing with 180 gallons per minute, against 15 to 20 ft. total head. A large motor and worm gear, as supplied to lift makers, is exhibited, consisting of an 8-H.P. compound-wound reversing motor direct-coupled on combined cast-iron bedplate to a worm gear capable of reducing from 700 to 16 R.P.M. An electrically-operated brake is provided between the motor and the worm gear.

An electrically-driven friction hoist (fig. 11) capable of lifting a load of 5 cwt. at 100 ft. per minute, suitable for handling goods outside warehouses, &c., and specially adapted for lifting sacks, bales, cases, &c., can be seen.

Finally, we may mention a 30-in. low-speed propeller fan, which is capable of handling 6,900 cb. ft. of air per minute at 450 R.P.M. when absorbing approximately 360 watts.

**British Vacuum Cleaner Co., Ltd.** (174, 189),

*Parson's Green Lane, London, S.W.*

An interesting assortment of vacuum cleaning machines is shown by this firm. These include their "Excelsior" "W." and "R.C.D." hand-power cleaners, their "Excelsior" ideal electric sweeper and the "B.B." electric cleaner. The model "L." electric vacuum cleaner is supplied with a ⅓-H.P. motor, and it weighs approximately 90 lb. The working vacuum is

Fig. 13.—Electric Vacuum Cleaner, Model T.

12 in. to 15 in. of water, and the pump revolutions per minute are 600 to 700. It is supplied for either A.C. or D.C. Models "R." and "T." (see fig. 13), which are also exhibited, are each driven by a ½-H.P. motor, and they weigh 120 and 140 lb. respectively. The former is for 15 in. to 18 in. working vacuum, and the latter for 20 in. to 24 in. There is also shown the "C.C." two-cleaner plant of the fixed rotary type, driven by a 2-H.P. D.C. motor (revolutions per minute, pump 650, motor 1,300). It weighs 2¾ cwt. Prices and illustrated particulars of all the foregoing and some other types are set out in the literature issued by the company.

**The Brush Electrical Engineering Co., Ltd.** (84, 89),
1, *Kingsway, London, W.C.*

The Brush Co.'s principal exhibit is a complete turbo-dynamo, which we illustrate herewith. The turbine is of the "Brush-Parsons" combined action and reaction mixed-pressure type; it is capable of an output of 400 KW. when working with high-pressure steam, or a mixture of high-pressure and low-pressure steam, and of 300 KW. when supplied with low-pressure steam at a pressure of 16 lb. per sq. in. absolute. It is designed to work with a vacuum of 28 in. of mercury, and at a speed of 2,500 R.P.M. The high-pressure portion of the turbine consists of a set of nozzles working in conjunction with an impulse wheel, having two rows of action blades; the steam is expanded in the nozzles from an initial pressure of about 160 lb. per sq. in. down to about atmospheric pressure. The low-pressure section of the turbine is of the pure "Parsons" type, in which the steam is further expanded down to an absolute pressure of about 1 lb. per sq. in. Under all conditions of working the steam distribution is under the control of the main governor, and the changes from high pressure to low pressure or to mixed pressure are performed automatically.

The dynamo is of the compensated type, and is fitted with auxiliary poles; the compensating winding counteracts the armature reaction, while the auxiliary poles produce a commutating field in a neutral zone. The armature is of the slotted drum type, and ventilating ducts are provided at frequent intervals to ensure efficient cooling of the core and winding. The commutator is mounted on a spider shaft through which the air is drawn to cool the inside of the armature, thereby ensuring a low temperature rise. Rings of special steel are shrunk on to the commutator at short intervals, and are insulated therefrom by mica rings.

A steam dynamo is also exhibited, with an output of 22·5 KW. at 250 volts when running at 625-650 R.P.M., and supplied with steam at a pressure of 200 lb per sq. in., exhausting freely to atmosphere. It consists of an enclosed vertical double-acting compound engine, fitted with a governor of the automatic expansion shaft type, and provided with forced lubrication, direct coupled to a D.C. generator of the slotted drum armature ironclad type. The dynamo is provided with a ball bearing of substantial construction, lubricated with grease, by the use of which several advantages are gained, wear being practically eliminated, while the attention required is reduced, the machine is shortened, and its efficiency is improved.

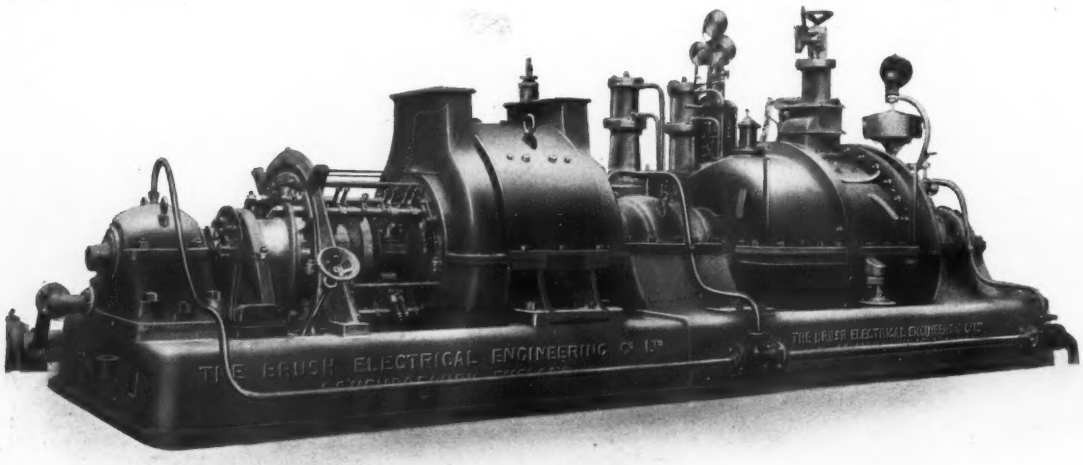



FIG. 14.—BRUSH-PARSONS 400-KW. MIXED-PRESSURE TURBO-DYNAMO.

Amongst other Brush exhibits are a variable-speed three-phase A.C. motor of the squirrel-cage type, with four running speeds (480 to 1,450 R.P.M.), obtained by changing the number of poles of the stator; a D.C. motor with ball bearings, and a 150-H.P. induction motor; various electrical travelling pulley blocks and hoists; the Brush portable electric grinder, specially designed for trimming the commutators of turbo-dynamos, but suitable for any other grinding operation; and the collector portion of the trolley gear for the Bremen system of railless trolley vehicles, which was fully described in our issue of June 9th last. The distinguishing features of the system are the arrangement of the two overhead wires, one above the other, and the ingenious type of collector, which, as shown in the accompanying illustration, combines the characteristics of the wheel and bow types of collector.

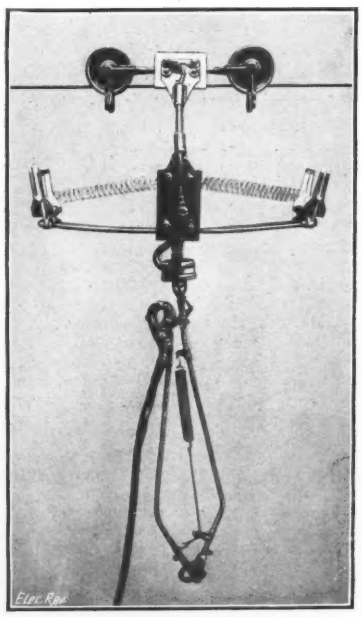


FIG. 15.—COLLECTOR OF BREMEN RAILLESS TROLLEY SYSTEM.

FIG. 16.—QUARTZLITE LAMPS AT MILLWALL.

The Brush Quartzlite lamp is shown in use for lighting the stand, and we reproduce a view of a steamship in Millwall dry dock, showing how effective this lamp is for illumination where work has to be carried on at night. There are four of these lamps on each side of the docks, each giving 2,500 to 3,000 C.P.; they have had to be screened on the river side, as they dazzled bargees in midstream. They have proved very satisfactory in penetrating fog.

Mention should also be made of the Brush "Metallum" high C.P. metallic-filament lamps, which are included in the exhibit.

**Messrs. Charles Churchill & Co., Ltd.** (85, 88),
*9-15, Leonard Street, E.C.*

Messrs. Churchill are showing a number of their grinding machines, of one of which we reproduce a photograph (fig. 17). This is a 10 in. × 24 in. Universal grinder, suitable for finishing shafts, spindles, cutters, reamers, &c., and can be used for external and internal and for face grinding, parallel or taper, to a very high degree of accuracy. Special attention has been given in the design to afford every convenience and great precision in setting angles, fixing the work heads, and arranging independently the speeds of work and wheel to the best advantage. The sliding surfaces are accurately scraped true, and lubrication is amply provided for. The

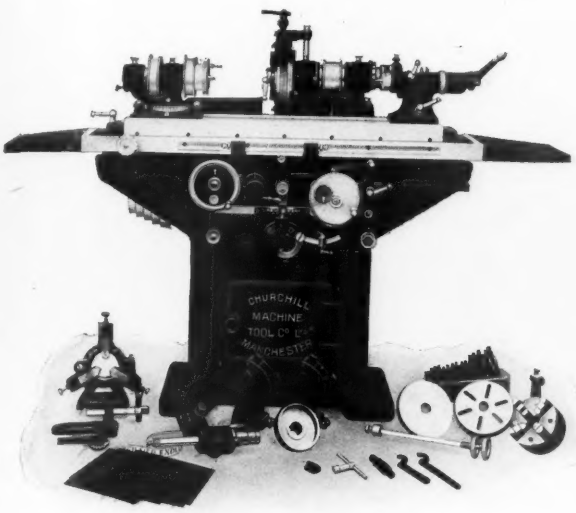



Fig. 17.—Churchill Universal Grinding Machine.

automatic wheel feed sizes the work to within 0·00025 in. The machine is available for a large and varied range of work. Amongst other machines of this kind shown by Messrs. Churchill (who specialise in this line) are a 10 in. × 60 in. plain grinding machine for shafts, &c., and a vertical surface-grinding machine taking work of 10 in. × 36 in. surface and 13 in. high.

**Joshua Buckton & Co., Ltd.** (122, 137),
*Well House Foundry, Leeds.*

This exhibit consists of one of the firm's improved table planing machines, to plane up to 10 ft. long, and to admit up to 4 ft. wide and 4 ft. high, with cutting speeds of from 25 ft. to 75 ft. per minute, and a return speed of from 25 ft. to 200 ft. per minute. The cross slide carries two tool boxes, and the machine is fitted with a side tool box on the near side arm. The cross slide tool boxes have self-acting feed motions for horizontal, vertical and angular cuts The side tool box has self-acting vertical feed motion and horizontal

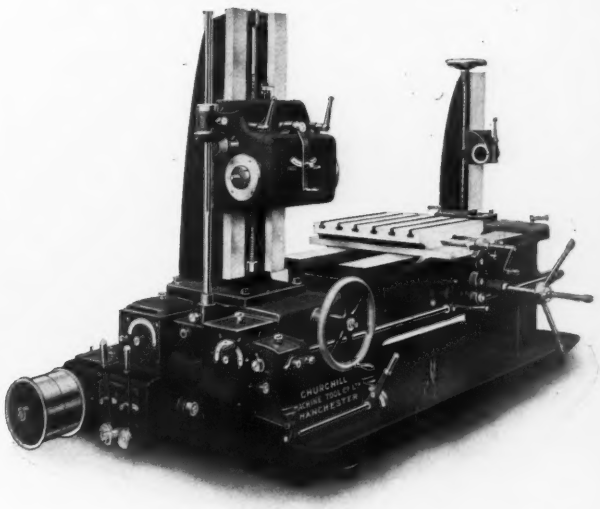



Fig. 18.—Churchill Horizontal Drilling, Boring, Milling and Tapping Machine.

and angular traverse by hand. The table is driven by a machine-cut spiral pinion gearing into a machine-cut rack on the underside of the table. On the outer end of this spiral pinion shaft is a spur-wheel driven by a similar steel spiral pinion, coupled up to the shaft of the reversing motor of the Lancashire Dynamo Co.'s "Lancashire drive."

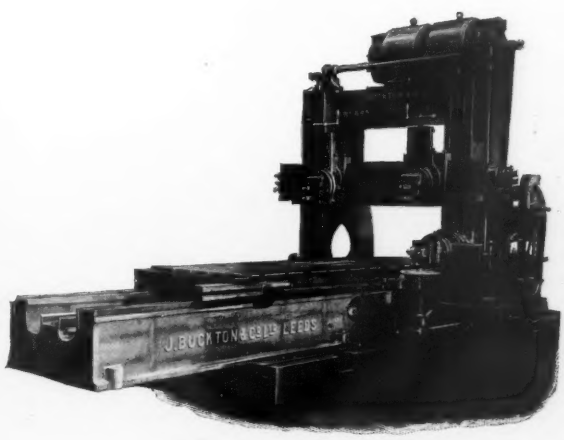



Fig. 19.—Buckton Electrically-Driven Planer.

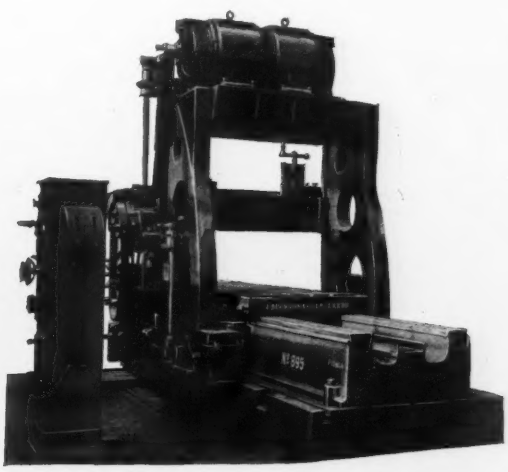


Fig. 20.—Back View of Buckton Planer, showing also Control Pillar.

Another exhibit which we illustrate (fig. 18) is a horizontal drilling, boring, milling and tapping machine, which is admirably adapted for dealing with engine and machine tool parts with rapidity and accuracy, the various adjustments being provided with graduated dials to show the exact distance moved. Such appliances as jigs and other special devices can be quickly dealt with on this machine. A gear box giving 16 speeds is provided, with a reverse for tapping. The work table measures 24 in. × 32 in., and a maximum travel of 51 in. can be obtained. The various indexes are graduated in thousandths of an inch, and the machine is built to limits of error of ·001 in. in 12 in. These, and the other exhibits on this stand, serve to show the extremely high standard of design and workmanship which characterises the machine tools made by Messrs. Churchill at their Pendleton Works.

With this spiral gear there are always a number of teeth, usually not less than four, in mesh simultaneously with the rack, and the motion of the table is effected noiselessly, with extreme smoothness, and without any jar or chatter, while the frictional resistance is reduced to a minimum.

A distinguishing feature, and one which tends greatly to increase the output of the machine, is Messrs. Buckton's patent power feed and traverse motion. By means of this gear the feed of any tool box, in any of its automatic motions, can be varied over the whole range from a fine feed to a broad finishing cut with suitable intermediate rates. The feed on all the motions can be stopped, reversed or varied instantly without stopping the machine. The cross slide can be rapidly traversed up and down by power, and all or any of the tool boxes can be rapidly traversed by power in any

of their automatic motions. All these various motions are actuated by the patent power drive, and all the regulating handles are conveniently arranged to be operated from one side of the machine, and from approximately one position. The facilities afforded by this gear for rapid adjustment and setting of the machine, and change of feed, enable great economy and increase of output to be attained.

It is claimed that by virtue of the all-spiral drive and the isolation of the feed gear from the reversing motion, the table can be reversed without shock or jar at the highest economic speeds. The bed is deep and of heavy section, with oil pockets formed in the sliding ways, and fitted with automatic lubricating rollers. The tool boxes are of improved construction, with double swivel motion, so that the tool can always be presented at a suitable angle to the work.

### Messrs. Ferranti, Ltd. (102, 113),

*Hollinwood, Lancs.*

Messrs. Ferranti's exhibit is arranged on novel lines, and comprises a great variety of material connected with switchgear, meters of various kinds, relays, motor starters and regulators, time switches, circuit-breakers, &c., as well as cooking and heating apparatus, and, of course, electricity supply meters of various patterns. Their D.C. motor starter (fig. 21) represents quite a new departure, being quite

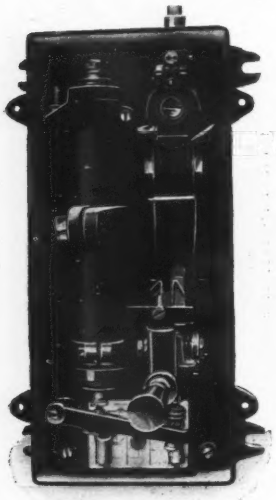


FIG. 21.—FERRANTI COMPRESSION-TYPE MOTOR STARTER.

FIG. 22.—TOTALLY ENCLOSED COMPRESSION TYPE STARTER.

unlike the customary types; it has no face-plate, and contains only two contacts—those of the circuit-breaker, which naturally are indispensable. The "compression-type" starter contains neither metal resistances nor asbestos, and in most of the patterns shown, mica is the only insulating material used. A non-metallic motor-starter was designed and introduced by the firm some five years ago, and the device under notice is a development of this type. The improvements consist of:—

1. The use of a non-metallic totally-enclosed ironclad resistance unit which is practically imperishable.
2. A reduction of the resistance gradually and continuously instead of by more or less considerable steps.
3. The elimination of the contact face-plate, contacts, and tappings to the variable resistance.
4. The use of only two contacts, one in the main circuit and one for short-circuiting the variable resistance.
5. The absence of slate or marble in all but the smaller sizes, and the use of moulded mica to the total exclusion of asbestos throughout the complete range.

The resistance unit consists of graphite disks contained in a steel tube, which is lined with a special refractory insulating material having exactly the same coefficient of expansion as the tube itself; the whole is raised to a temperature far in excess of any that can occur in practice even under the heaviest overloads. The variation of the resistance is obtained by applying pressure to the column of disks. The tubes are carried on and insulated from substantial metal clamps, and they can be affixed or removed in a few minutes. In the full "on" position the resistance is short-circuited by a switch constructed on the same lines as a circuit breaker, provided with rubbing contacts, which are laminated in the larger sizes, and fitted with sparking contacts, and magnetic blow-out. The main circuit is closed through a similar breaker mounted on the same arm as the short-circuiting switch, and both sets of contacts are readily accessible. This arm is operated by a simple system of link gear directly connected to the handle.

These starters are made in semi-enclosed, totally enclosed, and totally-enclosed ratchet motion patterns. A no-volt coil is an integral portion of the starter, and it permits of the addition of an overload attachment. The overload setting may be varied from 100 per cent. overload to 300 per cent. overload.

All the starters are enclosed in stout cast-iron cases: the semi-enclosed pattern has a slot in the cover for the handle, while the enclosed pattern has a hole through which a spindle passes, carrying either a hand-wheel or a lever (fig. 22). Slow motion is obtained by the addition of a ratchet gear to the enclosed pattern. The case of the totally enclosed pattern is weatherproof, and can be made watertight if required.

Each starter is provided with a push-button, by which it may be tripped. The starter may also be tripped from a distance if suitable provision is made.

Other notable features on this stand are the protected and ironclad type fuses. The former are designed to prevent the possibility of personal contact with live metal. All current-carrying parts are completely surrounded by insulating material when the fuse-handle is in position. The contacts are placed in non-conducting fireproof boxes, open in front and provided with internal projections, which guide the tongues into the contacts. The fuse wire is contained in a handle composed of a fibre tube enclosing one of hard asbestos. Metal clips secure the tongues to the asbestos, and the fibre tube is extended sufficiently to enclose the clips and cover the boxes containing the contacts. Two wide insulating flanges are mounted on the fibre tube, serving as hand-guards and as guides between the boxes and the fuse handle. Thus these fuses are safely and easily manipulated even in the dark, as the handle is guided between the boxes by the flanges, and the tongues are directed between the contacts by the internal projections.

The ironclad fuse consists of the front terminal pattern protected-type fuses, totally enclosed in a substantial weather-tight cast-iron case, designed to facilitate the replacement of the fuses. The construction of the case follows closely that of the firm's well-known ironclad switch, and allows for the attachment of special adapters permitting almost any form of cable connection.

FIG. 23.—IRONCLAD FUSEBOX WITH PROTECTED FUSES.

The ironclad fuses and the Ferranti ironclad switch can be assembled to form a unit, the fuse cover being interlocked with the switch handle, so that it cannot be opened unless the switch is in the "off" position.

FIG. 24.—HARTNELL "P" TYPE GOVERNOR (see page 469).

FIG. 25—HARTNELL ENCLOSED GOVERNOR.

These are samples only of the interesting display of apparatus, which is well worthy of a visit.

**Messrs. Wilson Hartnell & Co., Ltd.** (266),

*Volt Works, Leeds.*

The governors with which the name of this firm has been associated from our earliest recollection are well represented at this stand. A complete set of the original Hartnell vertical governors is shown, these being as popular and efficient as ever. The largest of these has an outside spring, to regulate the speed whilst the governor is running, and is so powerful that the work required to open the balls, lifting the sleeve 5 in. against the pressure of the spring, is no less than 600 ft.-lb. A somewhat similar governor is provided with an outside spring, closed dashpot, and double-acting dashpot spring. A governor on a horizontal shaft is also shown, this position being chosen in order to eliminate the disturbing effect of gravity, so that a very small variation of speed can be achieved. The "P" type governor is illustrated in fig. 24, p. 468. This is designed for small engines and turbines, and the balls work on roller bearings, the sleeve rests on rollers at the ends of the governor arms, and the main spring is supported on a ball-bearing plate. The result is that the governor responds extremely quickly to changes of speed. A type of almost identical appearance is made to have two distinct rises, the first commencing at 250 R.P.M., and being completed at 270 R.P.M.; the governor sleeve then remains stationary until a speed of 390 R.P.M. is attained, when it again begins to rise, completing the full rise at 404 R.P.M. This type is useful for acting through large variations of speed, for example, to prevent an excessive speed being attained by a hoist, while remaining unaffected over a wide range of speed below the predetermined limit.

Our other illustration shows one of the most recent designs of the Hartnell governor—an enclosed type, of which three examples are exhibited. Fig. 25 represents a pattern with long covers to accommodate the springs, which rest upon ball plates. These governors act with a high degree of accuracy—two or three per cent. variation of speed—and are much used for water and steam turbines, and small engines. One of those shown has two rises, one at 200 R.P.M., and the other at 2,000 R.P.M. Nine of the 11 governors are shown in motion, driven by a 4-H.P. 220-volt Hartnell motor.

**The Hart Manufacturing Co.** (76),

77, *Rochester Row, Westminster, S.W.*

This exhibit consists of a complete collection of the entire line of "Diamond H" switches and accessories, many of which have been illustrated in our pages. These switches, as is well known, are

Fig. 26.—"Diamond H" Three-Heat Switch and Cover.

made of the highest-grade materials and of approved construction, all working parts being made of case-hardened and tempered steel, contacts of spring phosphor-bronze, and insulation of India sheet mica. The break is exceptionally long and rapid on all the various lines, and the switches are made for practically every purpose. Among the company's more recent products are their remote-control

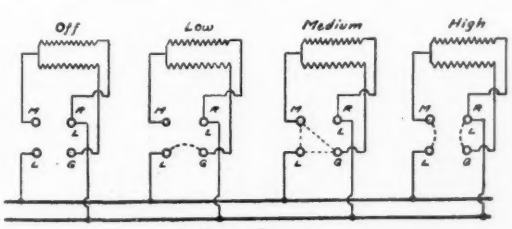



Fig. 27.—Connections of Switch.

switches, which they propose to place upon the British market very shortly. They have also just brought out a series-parallel switch for heater work. Of this switch we give illustrations in fig. 26, the connections of the same appearing in fig. 27.

**The Imperial Electric Co.** (164),

85, *Fleet Street, E.C.*

A portable vacuum cleaner operating from the electric lighting circuit is the leading exhibit of this firm The illustration (fig. 28) shows motor, fan, chamber, and dust bag attached to exhaust, the entire apparatus weighing only 9 lb. The motor in this cleaner makes 10,000 R.P.M., and enables the device to do very effective and rapid cleaning work. A feature of this apparatus is that the motor is suited to both alternating and direct currents of 90 to 250 volts pressure, and any periodicity from 25 to 90.

Fig. 28.—Imperial Electric Co.'s Portable Vacuum Cleaner.

A portable massage vibrator that gives 60 variations of massage stroke is also shown. It is in demand amongst physicians, masseurs, and hairdressers, and for private use.

Fig. 29.—Portable Massage Vibrator.

The illustration (fig. 29) shows the machine complete in case, with applicators for various purposes. The motor operates with both direct and alternating currents from 90 to 250 volts, and on various periodicities. Machines are also shown which are driven by dry-cells (self-contained).

Four different types of medical coils generating interrupted galvanic and Faradic currents are supplied by this firm for domestic

Fig. 30.—Imperial Electric Co.'s Medical Coil.

use; they make a speciality of these four lines. The machines are designed for treating different ailments in the home. Various electrodes can be supplied, all of which can be used on any of the four types of machine, one of which is shown in fig 30.

**The Sterling Telephone and Electric Co., Ltd.** (127, 132),

*200, Upper Thames Street, E.C.*

The Sterling Co.'s exhibit is one of bewildering diversity, their stands being fitted up with a prodigal display of telephones, bells, indicators, blasting machines, &c. The "Parlyphone" and more highly developed telephones for connection to domestic bell circuits are too well known to call for detailed reference, nor need we specify the numerous types of wall and table telephones for short and long-distance working; the "Primax" automatic interphone, however, which is of recent introduction, merits special mention, and we illustrate herewith one of the patterns in which it is made. The annoyance caused by induced overhearing and cross-talk on ordinary intercommunication systems is only too familiar a trouble,

Fig. 31.—Sterling "Primax" Automatic Interphone, Table Pattern.

Fig. 32.—Secret Conversation Lamp Signalling Interphone, Wall Pattern.

Fig. 33.—"Unitype" Indicator, Elevator or Ship Pattern.

enables the operator to carry on ordinary clerical work, besides attending when required to the telephone calls.

Passing over a variety of military and mining telephones, fire alarms, &c., we note as special features a gas and watertight electric trembling bell, in which the hammer is screwed to a flexible diaphragm, permitting the motion to be transmitted from the internal mechanism while the case is hermetically sealed; also the new "Thruster" bell, which has the whole movement enclosed in a waterproof cast-iron case, from which it can, however, be withdrawn complete on removing four screws, without disconnecting any wires. This is shown complete and dismounted in fig. 34.

Electric blasting machines capable of firing from two to 80 shots are shown, but we have space only in conclusion to illustrate the new "Unitype" bell indicator, fig. 33. This is made up of units, each complete in itself, so that contractors can build up indicators to any requirements without having to carry a large stock.

We understand that with few exceptions, all the apparatus shown was made at the company's works at Dagenham, in Essex.

**Messrs. R. Waygood & Co., Ltd.** (75, 97),

*Falmouth Road, London, S.E.*

Messrs. Waygood have on exhibition a full-sized electric passenger lift for conveying visitors to the gallery. It is operated by a car switch with self-centring detachable handle in the cage, the gates being fitted with electrical and mechanical locks to prevent the lift being worked while any gate is opened, and to prevent the gates being opened unless the cage is opposite the floor. They are also showing an electric service lift at work, capable of raising ½ cwt. at about 100 ft. a minute through a travel of about 15 ft. This lift will be controlled by three pushes, "up, down and stop," and will represent the latest design of this type of lift. Another item is a model of one of their improved hand-power lifts for private residences, operated by handle and controlled by foot-brake, the cage being guided by round steel runners. A model of an electric push-button passenger lift, dispensing with the necessity of an attendant, and therefore specially adapted for the use of private houses, is also on view, together with a number of the firm's accessories.

**Messrs. Adams Manufacturing Co., Ltd.** (107, 108),

*106, New Bond Street, W.*

Motor controlling apparatus "of infinite variety" is the keynote of the "Igranic" exhibit. To select the leading features of this display for special notice is a difficult task—there is nothing that does not merit notice, but not *all* the items can be dealt with in the space at our disposal. Fortunately, we have in previous issues illustrated some of them, and we may, therefore, be content with only mentioning the Igranic ironclad motor panels of the pillar type (standardised in 13 different combinations), which are well represented; in these starters all the main contact-making and breaking is removed from the contacts of the starter to the automatic circuit-breaker, and the whole of the operating is done with one handle. The multiple switch starting rheostat, and the patent inching starter for printing machines, &c. (with circuit-breaker interlocked with starter handle), have also figured in our pages. The company show the latest type of automatic solenoid self-acting starter, combined with a clapper type main switch, with carbon break and magnetic blow-out; this is suitable

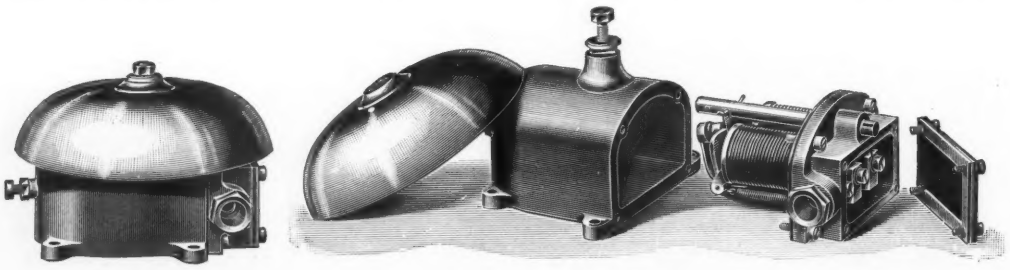


Fig. 34.—"Thruster" Bell, complete and dismounted.

but in the "Primax" system it is so far eliminated as to be negligible. Local batteries, also a fruitful source of inefficiency, are dispensed with, a single central battery sufficing to operate the whole system, up to as many as 30 stations. Yet only two additional common wires are required in the cable, and the instruments cost no more than their forerunners. Calls may be received and answered irrespective of the position of the line selector, and the act of replacing the receiver or hand combination restores the lever in the type illustrated to the normal position.

In the "Era" automatic interphones for double lines, which are also well represented, cross-talk is, of course, entirely eliminated; but the limit is reached in the lamp-signalling secret conversation interphone shown in fig. 32, which combines the advantages of the foregoing designs with an absolutely secret, non-tappable service. The use of lamps for signalling minimises the number of moving parts, so that these instruments are not likely to get out of order, and the visual lamp signal facilitates quick operation, besides affording to the caller himself a definite indication whether the person called is engaged or not.

One of the most prominent features of the exhibit is a handsome combination table lamp-signalling switchboard, in the form of an office bureau. This can be equipped for 100 stations, and for the automatic control of pumps, air compressors, &c., or the remote control of any kind of machine. Fig. 35, p. 471, illustrates a combined "double arm" starter and speed regulator for use with shunt or compound-wound motors, fitted with no-volt and overload releases, and renewable contacts. This first starts and then regulates the motor, and is so interlocked that the motor must be fully excited before the armature circuit is closed. Fig. 36 shows a neat little treadle-operated starter and regulator (with cover removed), for sewing machines and similar small treadle-operated machines. In this ingenious device, which is easily fixed under the table of the machine, the main circuit is closed by a disk bridging the two lower posts; the latter are magnetised, and hold the disk until the spring forces it off, when at the same time a quick break and a magnetic blow-out are produced. For a quick stop the disk is forced up to engage with the upper pair of posts, short-circuiting the armature and giving a dynamic brake.

Another phase of automatic control is shown in fig. 37—a patent controller for electrical organ-blowing with a bellows; as will be seen, a chain or rope from the bellows actuates the regulating resistance, giving any variation from full speed to rest.

Several types of lift controllers are exhibited in operation, including a full automatic push-button controller. The Adams

Igranic remote control switches are also shown, as well as "type L" oil-immersed starting switch, for use with auto-transformers, or for star-delta connection; this is of the throw-over type, and possesses some exceptionally good features. The switch must be closed on the starting side, before it can be turned to the running position, and the handle cannot be left in the starting position. Overload coils can be connected in two of the phases on the running side, with only a portion of the windings in circuit on the starting side, so that the switch will not trip with the starting current, unless overload conditions exist.

Fig. 35.—Adams "Igranic" Starting and Regulating Rheostat.

We must not omit to mention the Adams Igranic theatre dimmers of the metallic type, as used at "The Little Theatre" (Electrical Review, October 21st, 1910), and many other theatres, which are being used to control some of the lighting on the stand.

As above-mentioned, many of the firm's devices will be shown at work, and we have no doubt that visitors will find it well worth their while to see them.

### Allen West & Co., Ltd. (202, 213),

*Lewes Road, Brighton.*

The leading feature of this exhibit is controlling gear. Reversing drum type controllers for both A.C. and D.C. circuits, fitted with various forms of operating gear for crane and general industrial work; drum type machine-tool controllers to give a large range of speed control on shunt motors; heavy duty controllers for steel works; oil-immersed controllers for general use in fiery mines; liquid haulage controllers, also for use in fiery mines; improved unit type resistances and unbreakable stamped resistance grids, and drum type collector columns for use on cranes, are included, and several of the special features referred to below are covered by patents.

A noticeable feature of the apparatus exhibited is the massive construction of all parts; the fingers used on the drum controllers are of the mechanical hinged type, and obtain their pressure from spiral springs instead of the usual flat type. Each finger is securely attached to a machined terminal base, rigidly clamped on to a mica-insulated steel bar, and is thus mechanically held in the right position. All the fingers are fitted with heavy renewable contact tips of hard-drawn copper, and the current is carried from the finger to the terminal base by a heavy shunt of laminated copper. The finger tip has a stud permanently screwed into it which passes through a hole in the hinged finger back, and is held thereto by a nut and lock-washer; the trouble of replacing tips attached by separate screws which weld to the worn copper is thus obviated. The drum rings and finger tips are of more massive section than is usual, this provision having a considerable cooling effect on the arc, which greatly prolongs the life of the wearing parts. Of the many types of controller shown, we have selected for illustration an A.C. drum-type controller for 350 H.P. at 440 volts (fig. 38). This contains two drums working in parallel through gearing, and actuated by a single handle. It also illustrates the special provision which is made to facilitate the connections with external wiring.

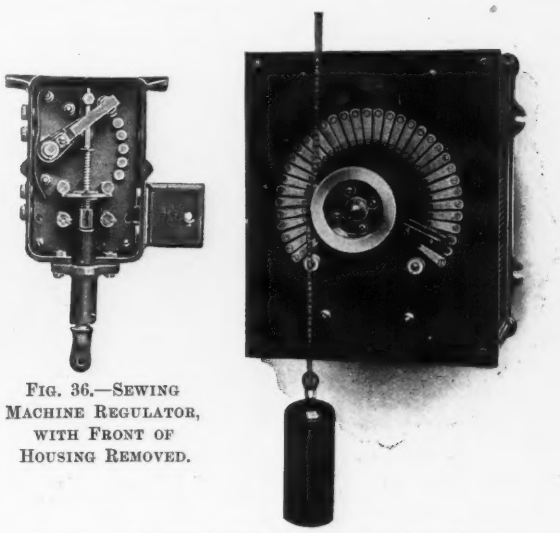


Fig. 36.—Sewing Machine Regulator, with Front of Housing Removed.

Fig. 37.—"Igranic" Controller for Organ Blowing.

Machine tool controllers for shunt-wound motors, designed to provide a large range of speed regulation by means of resistance in the shunt field circuit, are exhibited, of drum type throughout; a single handle controls the motor speed throughout its whole range, and it is impossible to reach the high-speed notches without first passing through those provided for starting.

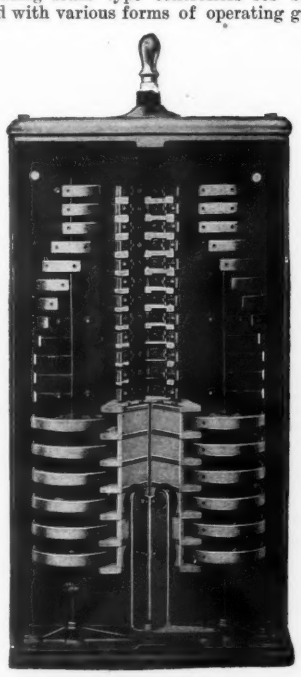


Fig. 38.—Allen West & Co.'s 350-H.P. A.C. Double-Drum Controller.

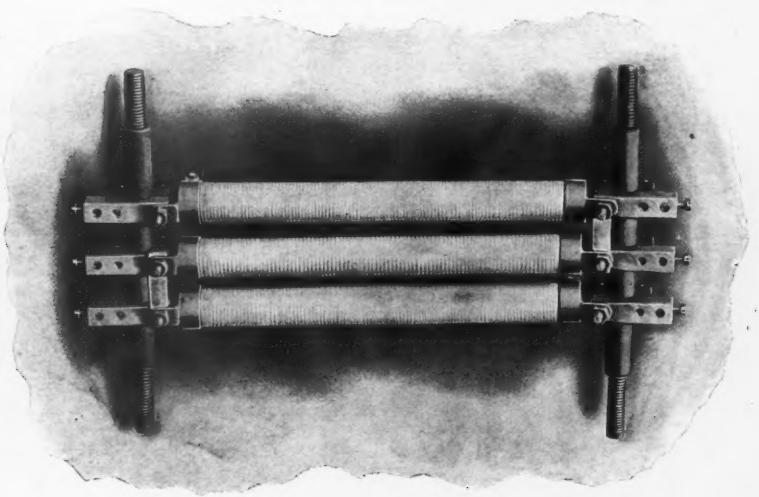


Fig. 39.—Resistance Unit on Mica-Insulated Rods.

Steel works controllers are shown of the face-plate pattern, but constructed on the latest lines, with particularly massive contacts and mica insulation. They are provided with protecting covers,

which are easily detachable for inspection, but effectively prevent the entry of the dust and dirt which are usually prevalent in the situations where they are employed. A very large number of notches are provided in both the forward and reverse directions, so that easy starting is ensured, and a powerful magnetic blow-out acts on each notch.

Examples of the firm's resistance specialities are shown in the improved unit construction and patent unbreakable stamped grids. In both cases the resistances are carried on mica-insulated steel

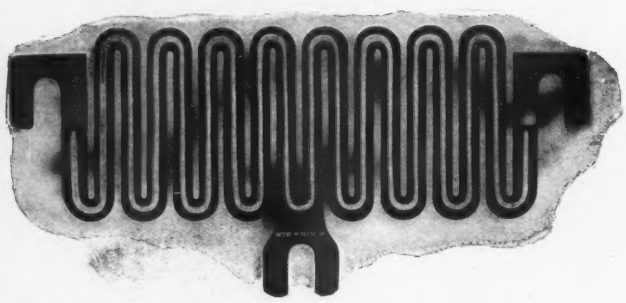


Fig. 40.—Unbreakable Stamped Resistance Grid.

bars, so that a fireproof construction results. The units are of the wire type, wound on steel tubes. They are thinly coated with a special cement, and provided at the ends with heavy clamped terminals, which entirely obviate the troubles which occur when resistance elements of this type are only provided with thin strip or wire terminals. The great feature of the stamped grids is, of course, their mechanical strength, which makes a breakage from any cause almost impossible. They are particularly suitable for use in situations where there is considerable vibration, and will also appeal to shippers for export purposes. In both the grids and units the resistance material used is of negligible temperature coefficient, and there is no danger of deterioration due to rusting. We illustrate both these items, as well as a crane collector column made on the drum principle, in which standard controller fingers are employed. Mica insulation is used throughout, and bearings are provided so that the fingers and rings are always in perfect alignment and there is no danger of improper contact being made, which is often the case when the fingers are supported from some part of the moving or fixed portion of the crane without any means being provided to preserve their exact alignment with the rings.

Oil-immersed controllers of two sizes are exhibited, one being of the drum type throughout, which is used for the smaller horse-powers, and one for the larger sizes, having separate oil-immersed reversing switches. In these controllers the drum portion is of the

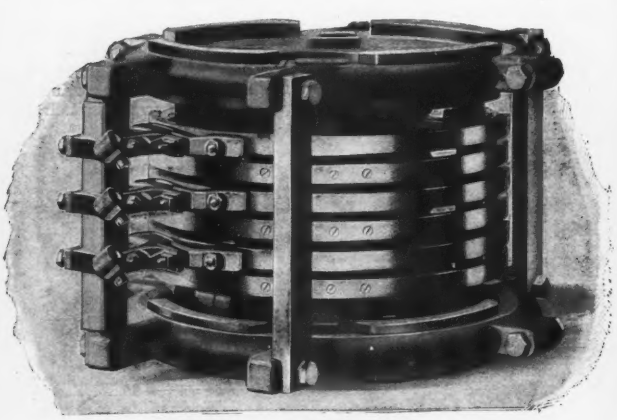


Fig. 41.—Allen West Crane Collector Column.

horizontal type with drum rings of even more massive section than those used in the non-oil-immersed lines. Provision for inspection is made, so that it only takes a few seconds to have the contacts exposed for inspection or renewal.

The firm claim that their liquid controllers are the first to be put on the market in which a scientific circulation of the resistance liquid is employed. In these controllers a single hand-wheel or lever performs all the functions necessary for starting, stopping, reversing and speed regulation. The movement of this operating gear from its "off" position first closes the oil-immersed stator or line switches, and further movement reduces the liquid resistances in the rotor or slip-ring circuit until the "full on" position is reached. All the various parts are mechanically interlocked, so that it is impossible for them to operate in any but the correct order.

**Gent & Co., Ltd.** (169),

*Faraday Works, Leicester.*

Clocks, telephones, alarms and bells—these are the lines that the visitor always expects to find, and to find effectively displayed, at an exhibit arranged by Messrs. Gent & Co. On the present occasion once more this expectation is realised. The exhibit accord-

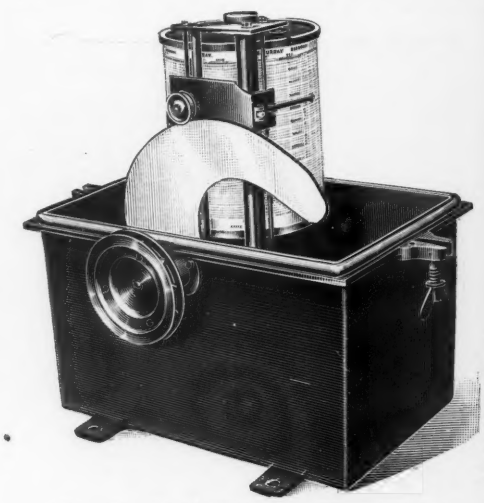


Fig. 42.—Gent's Water Level Recorder.

ingly includes first of all their electrical impulse clocks for turret house, or factory use, by which accurate and uniform time can be maintained throughout an establishment, including any number of clocks, all working together without any periodical winding. The only attention needed is that required by the battery (which is of the ordinary Leclanché type) say once in 12 months, of which timely warning is given by their "weak battery warning" bell. The Parsons-Sloper secret and other telephones, as made for the General Post Office and leading railways, are able to secure for us secret conversation between any two points in connection, throughout a system of intercommunication telephones connected

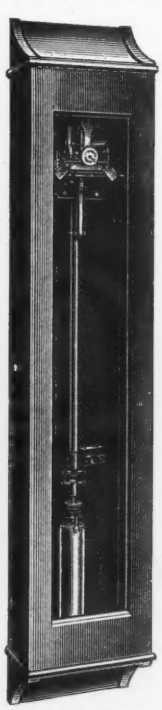
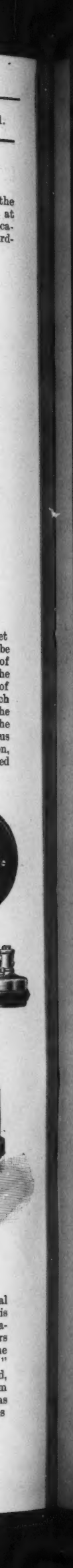


Fig. 43.—B.P. Patent Impulse Transmitter.

Fig. 44.—Parsons-Sloper Secret Interphone.

on ordinary single-line intercommunication wiring. In commercial houses as well as in some other places, secrecy of conversation is essential, and an important advantage also is that such conversation cannot be interrupted by a third party. Water-level indicators and recorders (fig. 42) are shown for recording at any distance the rise or fall in the water-level at a reservoir or tank, "inch by inch" as the variation takes place; water-level alarms are also exhibited, and electric dry ink marking tell-tale clocks, for checking asylum attendants, night watchmen and others. A system which has been adopted for many years past for asylums, workhouses



hospitals and large works, is also to be seen here, as well as electrical bell indicators, with special designs of pendulums, drop or mechanical replacement indicators, ships' indicators, semaphores, and a variety of water-tight and other bells.

**Messrs. E. Bennis & Co., Ltd.** (200, 215),

*Little Hulton, Bolton.*

This firm has an interesting boiler-house exhibit, showing two types of mechanical stokers, fed by means of bucket elevators, distributing shoots and band conveyors. There are five separate parts to the exhibit, constituting a complete coal and ash-handling plant. Different methods of supplying coal to two types of mechanical stokers are demonstrated—the "Bennis" high-temperature coking stoker fitted to an internally flued boiler, and the "Bennis" new-link chain grate stoker fitted to a water-tube boiler. A "Bennis" elevator, fitted with rotary feed and special chain and buckets for boiler-house use, is shown elevating the coal to bunkers composed of riveted plates and supported on massive stanchions. Part of the bunker is provided with a hopper bottom, and fuel is fed direct from the bunker into the coking stoker. A shoot leading from the bunker feeds the chain-grate stoker. The fuel thus fed

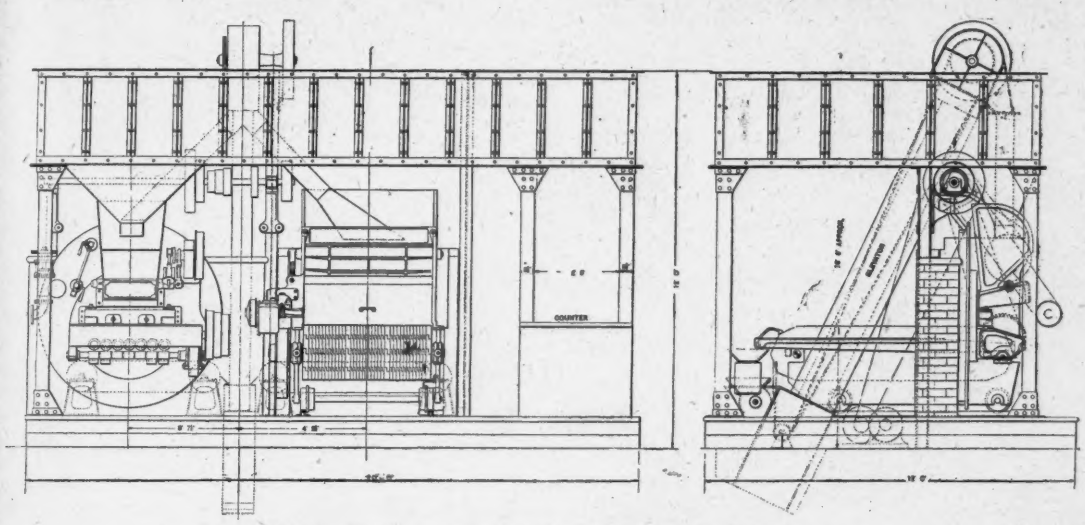



FIG. 45.—ARRANGEMENT OF BENNIS BOILER-HOUSE EXHIBIT.

into the stokers travels along the bars, and after passing through the furnace falls on to band conveyors. These illustrate the latest type of "Bennis" band conveyor with built-up idlers and adjustable self-oiling bearings. The conveyors feed into the boot of the elevator mentioned above. The entire process is continuous, and the plant is driven by an A.E.G. motor. Winn mountings are fitted to the boiler fronts.

The "Bennis" high-temperature smokeless and gritless coking stoker shown is of the latest type, with patent air-cooled doors, and cooling plates round the stoker front. This stoker and self-cleaning compressed-air furnace will burn, according to the draught, from 10 to 60 lb. of fuel per sq. ft. of grate per hour without smoke or grits. By its design, large evaporative boiler capacity, economy and flexibility are ensured.

The "Bennis" patent new-link chain grate stoker embodies many improvements. The links are halved together and rounded at their ends, and the drive is adapted to give six variations of speed to suit various classes of coal and varying loads. The grate can also be used with forced draught. The provision of the patent air-seals, which prevent the entry of an excess of air at the sides, the machine-cut six-speed gear running in oil, and ball-thrust bearings are among the improvements that render this smokeless chain-grate stoker admirably adapted for all types of water-tube boilers. It has been adopted by the Admiralty, and excellent results are being obtained in the boiler-houses of many electrical undertakings in the United Kingdom and on the Continent. A "Bennis" automatic $CO_2$ recorder and calorimeter are also exhibited.

**Messrs. Major & Co., Ltd.** (142),

*Sculcoates, Hull.*

This firm, who are manufacturers of insulating varnish, compounds and other allied specialities, are exhibiting a full range of their manufactures as used in the electrical trade. They will also have in operation a high-tension testing set and other apparatus on which demonstrations will be given. A special Exhibition sample offer is being made in order that users may have an opportunity of carrying out a proper works test in bulk. We are asked to state that at the stand literature will be available describing the manufacture of insulating varnish. All their products are tested before going to the customer, and the firm's chemical and electrical laboratories are fitted with all the necessary plant for carrying out these tests.

**Litholite, Ltd.** (201-214),

55, *Hackney Grove, N.E.*

Here the following articles are being shown:—Litholite non-hygroscopic insulators, moulded into the form of handles for use on switchboards, starters, &c., bushes, washers, caps for covering projecting bolts and nuts, bobbins, winding supports, terminal blocks for use on motors and dynamos, insulated spindles and washers for brush-gear, tube-end bushes for conduit wiring, electrolier nipples, telegraph insulators, &c. We are informed that a test made by Faraday House on August 4th, 1911, on a litholite disk 21·4 cm. diameter by 0·651 cm. thick, showed a resistivity of 108,000,000 megohms with a testing pressure of 500 volts, the temperature of the room being 78° F. XX grade (fire-resisting) shields for covering lampholders to meet Home Office requirements are also exhibited.

**British Metal Engraving Co., Ltd.** (267),

*Kingston-on-Thames.*

On this stand, which will be found in the gallery, there is a very varied assortment of nameplates, dials, scales, &c., all of which are made at the firm's works in Kingston-on-Thames, in different finishes, engraved brass as well as aluminium. Nameplates for motors, dynamos, installations, &c., from the usual raised brass lettering on sunk black ground to complicated coloured artistic plates are displayed, as well as circular and shaped counter disks, with the numbers in a circle, and meter plates in every different style. In addition, there are large quantities of plates with blank spaces for stamping on the numbers of watts, revs., ohms, H.P., as well as the speeds, type, number, &c., all with engraved lettering to show up permanently on the apparatus to which they are affixed. Dial plates for meters, with the divisions imprinted on aluminium, and holes through which a pointer protrudes, are also shown. Celluloid and bone labels for switchboards, &c., form a popular side line. Almost every sample plate in evidence advertises some familiar firm of electrical and engineering manufacturers or representatives.

**The Brimsdown Lamp Works** (100, 115),

*Kingsway House, London, W.C.*

This company has a good show of the Brimsdown metallic-filament lamps, manufactured under the colloid-tungsten and later patents, which, the exhibitors claim, confer upon them the sole rights of manufacture of lamps under this process in Great Britain. The advantages claimed for the colloid-tungsten lamps are that the filament is more homogeneous and has a longer average life than other types, and possesses the highest possible efficiency; and its good qualities have been recognised by many British and Colonial Government departments, electricity supply authorities and other important concerns. The facia of the stand is outlined with an entirely new reflector illuminating strip, and other devices combine with this to render the stand well worthy of a visit. The lamps are, of course, entirely British made, and are manufactured in all the usual patterns.

**Messrs. J. Hopkinson & Co., Ltd.** (170, 193),

*Britannia Works, Huddersfield.*

This exhibit comprises a full-size model Lancashire boiler equipped with Hopkinson's patent safety boiler mountings and valves, and an archway of valves for various purposes. There is also a small archway showing the Hopkinson-Ferranti patent stop valve as compared with the ordinary mushroom and the parallel slide type.

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**Inquiries.**—A correspondent wishes to get into touch with makers of machinery for manufacturing electric conduits and fittings. Particulars of oil fuel systems suitable for application to Lancashire or dryback marine-type boilers, and the name of makers of the Weber luxometer, are asked for.

# CONTRACTS OPEN and CLOSED.

## OPEN.

**Aston Manor.**—September 29th. 20,000 tons of coal for the electricity works of the T.C. R. Foster, borough electrical engineer.

**Australia.**—Victoria.—October 3rd. 42 miles of paper-insulated, lead-covered telephone cable, for the P.M.G. See "Official Notices" August 18th.

Western Australia.—October 18th. 20 coin-in-the-slot attachments for the P.M.G. See "Official Notices" August 25th.

November 21st.—One automatic or semi-automatic switchboard and equipment, for the P.M.G.'s Department. See "Official Notices" September 15th.

South Australia.—October 25th. Cable and paper sleeves for the P.M.G. See "Official Notices" September 1st.

Sydney, October 30th.—Five turbo-alternators of 5,000 kw. each, for the New South Wales Government Railways. Full particulars from Electrical Engineer's office, 61, Hunter Street, Sydney. This contract was advertised in the *Sydney Telegraph* of July 29th and the matter is referred to fully in our "Tramway Notes" of last week.

South Australia.—November 1st. 5,000 insulators, porcelain No. 8, for the P.M.G.'s Department. See "Official Notices" to-day.

New South Wales.—December 20th. One branching multiple magneto switchboard at Broken Hill, for the P.M.G.'s Department. See "Official Notices" to-day.

**Bristol.**—October 2nd. One 10-ton and eight 2-ton high pedestal travelling jib cranes, electrically driven, Royal Edward Dock, Avonmouth, for the Docks Committee of the T.C. W. W. Squire, Engineer, Cumberland Road (returnable deposit of £5).

**Cape Colony.**—Wynberg.—September 25th. Tenders are invited for street lighting, for a public supply of electrical energy to the Council, and to private consumers. Particulars from the Town Clerk.

**France.**—The Chemins de Fer de l'Etat propose to acquire 450 electric motors for the electrification of the suburban tramways. Particulars from Le Service Electrique, 43, Rue de Rome, Paris.

**Halifax.**—September 26th. Electrical fittings for six months, for the B.G; A. T. Longbotham, clerk, Carlton Street.

**Hastings.**—October 18th, Electric lighting of the workhouse, Ore, for the B.G. See "Official Notices" September 15th.

**Hungary.**—October 2nd. Tenders are invited for the establishment of an electric public and private lighting service at Paszto, in the province of Heves, Hungary.

**Keighley.** — September 25th. Coal-handling plant, storage reservoir for 200,000 gallons of water, and two circulating pumps, for the Corporation Electricity Works. See "Official Notices" September 8th.

**Liverpool.**—September 26th. Electric supplies for a year, for the West Derby B. of G.; H. P. Cleaver, clerk, Brougham Terrace, West Derby Road.

September 30th. Electric lifts and electric light fittings for the Select Vestry, at the Workhouse, Brownlow Hill. G. W. Coster, vestry clerk, Brownlow Hill.

**London.**—L.C.C.—October 24th. Sub-station plant and machinery. See "Official Notices" September 15th.

October 12th. 100,000 pairs of white open type type arc lamp carbons, for the B.C. See "Official Notices" to-day.

September 27th. Extension of the telephone systems at the Guardians' buildings at Homerton. See "Official Notices" September 15th.

**Manchester.**—September 25th. The Corporation is inviting tenders for electrical machinery, plant, and wiring for Elm Street Cold Storage Warehouse. Specifications and forms of tender from the Superintendent, Markets Department, Town Hall.

October 4th.—One 4,000-4,500 kw. low-pressure exhaust type turbo-alternator, for the Corporation. See "Official Notices" September 15th.

October 3rd.—For (*a*) permanent way special track work; (*b*) permanent way points, tongues, and hardened steel centres; (*c*) granite setts, Specifications and forms of tender obtainable from Mr. McElroy, general manager. Deposit £2 2s. (returnable).

**Radcliffe.**—Proposed new fire-alarm system, about £400.

**Sheffield.**—A large water-tube boiler capable of evaporating 21,000 lb. of water per hour to replace a small marine type of boiler at the tramways power station, Kelham Island.

**South Africa.**—Port Elizabeth.—October 19th. The T.C. requires tenders for the supply of (*a*) electric motors, and (*b*) electric motor-starter panels. Specifications from the Municipal Electrical Engineer Tenders to Town Clerk.

**Spain.**—The municipal authorities of Segorbe (province of Castellon) have lately invited tenders for the concession for the electric lighting of the town during a period of five years.

**Taunton.**—September 25th. Steam coal for a year (about 2,500 tons), for the electricity works. A. J. Howard, borough electrical engineer.

**York.**—September 23rd. Supplies for a year, for the City Electricity Department. See "Official Notices" September 15th.

## CLOSED.

**Australia.**—Melbourne.—The City Council has placed an order with Messrs. Siemens Bros. Dynamo Works, Ltd., for a Tudor battery (4,000 amperes for one hour), which is to be put at the centre of the area of densest demand.

Mr. C. W. Webster, of Bradford, who is representing the Compania Fabril de Carbones Electricos, of Barcelona, has received instructions from Messrs. McIlwraith, McEacharn & Co., Ltd., of London, to supply the Melbourne City Council with a very large quantity of flame carbons, (approx. 700,000 ft.). The firm are makers of beacon flame carbons, and Mr. Webster has lately received contracts and orders to supply these to Sheffield, Leeds, Halifax, Wallasey, Coventry, Sunderland, and other corporations.

**Blackburn.**—The Guardians have accepted the tender of Messrs. J. W. Garsden & Co., at £192, for an electric hooter, in place of the compressed-air hooter previously recommended for acceptance.

**Bolton.**—The Electricity Committee has accepted the tender of Mr. J. B. Scholes for 25,000 tons of coal.

**Brighton.**—The T.C. has been recommended to have the No. 5 turbine at the electricity works reconstructed by the British Westinghouse Electric and Manufacturing Co., Ltd., at a cost of £4,980.

**Government Contracts.**—The following tenders have been accepted by the Government department named, during the past month:—

War Office.

Cable, electric, &c.—British Insulated and Helsby Cables, Ltd.; W. T. Henley's Telegraph Works Co., Ltd.; Hooper's Telegraph and India-Rubber Works Ltd.; India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.; London Electric Wire Co., & Smiths, Ltd.; Midland Electric Wire Co., Ltd.; St. Helens Cable and Rubber Co., Ltd.; Siemens Bros. & Co., Ltd.
Generating set.—Siemens Bros. Dynamo Works, Ltd.

India Office, Store Department.

Armatures and electrical fittings.—J. Stone & Co.
Cells.—Siemens Bros. & Co.

Crown Agents for the Colonies.

Telephones, &c.—Western Electric Co., Ltd.
Wireless installation.—Marconi's Wireless Telegraph Co., Ltd.

Office of Works.

Cables for Imperial College of Science.—Siemens Bros. & Co., Ltd.

G.P.O., Stores Department.

Telephonic apparatus, bell sets.—British Insulated and Helsby Cables, Ltd.
Flexible cords.—British Insulated and Helsby Cables, Ltd.; London Electric Wire Co., & Smiths, Ltd.
Plugs.—British L.M. Ericsson Manufacturing Co., Ltd.
Paper core cable.—Western Electric Co., Ltd.
Dry cells.—Siemens Bros. & Co., Ltd.
Desiccators.—Lacy-Hulbert & Co., Ltd.
Detectors.—General Electric Co., Ltd.
Lightning protectors.—British L.M. Ericsson Manufacturing Co., Ltd.

G.P.O., Engineering Department.

Electric lifts, District Office, London, W.C.—Medway's Safety Lift Co.
Telephone extension, Mayfair Exchange.—Western Electric Co., Ltd.

**London.**—Poplar.—The Electricity Committee received the following tenders for plant in connection with the extensions to be carried out at the generating station:—

Two water-tube boilers, fitted with underfeed stokers, and hot-air economisers.

Stirling Boiler Co., £7,673 (three motors) (not according to specification); first alternative, £7,802 (four motors) (do.); second alternative, £7,969 (two motors).
Babcock & Wilcox, £8,190 (two motors).
Howden Boiler Co., £8,200 (three motors) (not according to specification) first alternative, £8,408 (four motors) (do.); second alternative, £8,60 (two motors).
Clarke, Chapman & Co., £8,871.
Fraser & Chalmers, £10,498.

In the opinion of the electrical engineer the tender of Messrs. Babcock & Wilcox, at £8,190, should be accepted, and instead of both boilers being fitted with underfeed stokers and hot air economisers, he recommends that one only be fitted in this manner, and the other with close-link travelling grate, with water economiser and induced draught. The cost would be the same in either case. The advantages of the Babcock & Wilcox boilers, the engineer states, are:—(1) Short, straight tubes, greatly facilitating inspection and cleaning, and thus obviating difficulties experienced with bent tubes. (2) Exceedingly high evaporation results have recently been obtained on the Continent, which go to prove that the evaporative capacity of this class of boiler has been hitherto much underrated in this country. (3) The grate area of the boiler put forward is greater than that of any of the other types. This, in his opinion, is a particular feature in obtaining the best evaporation in any boiler. (4) By the proposed special arrangement of induced fan draught, the fan is not influenced in any way by the hot gases, and, in combination with the considerably increased length of

grate, the capacity can be raised by at least 15 per cent. to 20 per cent. After considering these facts, the Committee have come to the conclusion that although the tender of Messrs. Babcock and Wilcox was £207 in excess of the lowest tender, the extra cost would be more than counterbalanced by the superiority of this type of boiler, and they accordingly recommend that the tender of Babcock & Wilcox to supply and erect on foundations provided by the Council two water-tube boilers, and fitted with underfeed stokers and hot air economisers, and the other with close-linked travelling grate, with water economiser and induced draught, at £8,190, be accepted.

For the supply and the erection of a 30-ton electric overhead travelling crane the following offers were received :—

Chatteris Engineering Co., £845.
Jas. Carrick & Sons, £912.
A. Jack & Co., £950.
Royce, Ltd., £960.
S. H. Heywood & Co., £961.
Alternative, £1,060.
Cowans, Sheldon & Co., £995.
J. Booth & Bros., £995.
C. & A. Musker, £998.
Marshall, Fleming & Co., £1,010.
Babcock & Wilcox, £1,025.
Stothers & Pitt, £1,040.
Sir Wm. Arrol & Co., £1,046.
Herbert Morris & Bastert, £1,052.
Howden Boiler Co., £1,045.
First alternative, £1,104.
Second alternative, £1,134.
Third alternative, £1,290.
Ransom & Rapier, £1,155.
Carrick & Ritchie, £1,189.
Alex. Chaplin & Co., £1,220.
J. Carter & Sons, £1,295.
Craven Bros., £1,310.
Jas. Spencer & Co., £1,390.
J. Smith, £1,395.
J. Henderson & Co., £1,605.
Alternative, £1,650.

Reporting on these tenders the Engineer states that he had carefully examined the details of each tender, and was convinced that Messrs. Royce's crane had certain distinct advantages over other makes. The most prominent were (1) hoisting gear, and all rims of driving wheels, &c., are made of wrought steel, and teeth cut out of the solid. (2) Roller bearings throughout, reducing friction to a minimum. (3) The whole of the crane and motors are made complete by one firm. (4) Special patent arrangement, known as slipper drive, whereby it is rendered impossible to overload the motor. (5) The general arrangement of running the cables from motors to the operating cradle is one which allows very great facility in testing and general examination. The engineer further states that two cranes made by this firm were now in use at the destructor works and were working satisfactorily, and that, in his opinion, the tender of Messrs. Royce, Ltd., at £960, should be accepted. The Committee have recommended accordingly.

The following tenders have been received for one overhead bunker, one combined coal elevator and conveyor, and extension to existing coal conveyor :—

Tickle Bros.—(*a*) Bunker, £1,076; (*b*) new conveyor, £490; (*c*) extension of existing conveyor, £420.
New Conveyor Co.—(*a*) £1,188; (*b*) £609 10s.; (*c*) £444 10s.
Bennis & Co.—(*a*) £1,270; (*b*) £610; (*c*) £530.
Spencer.—(*a*) £1,212; (*b*) £865; (*c*) £451.
Edgar Allen & Co.—(*a*) £1,730; (*b*) £818; (*c*) £522.
Barry, Hendry & Co.—(*a*) £2,050; (*b*) £575; (*c*) £490.
Babcock & Wilcox.—(*a*) £2,100; (*b*) £760; (*c*) £373.
Dempster & Sons.—(*a*) £1,654; (*b*) £1,015; (*c*) £787.

The Committee have decided to accept the tender of Babcock and Wilcox for extending the existing conveyor, at £373, and to defer the consideration of (*a*) and (*b*) for further examination. At the meeting of the Council, on September 14th, the recommendations of the Electricity Committee were carried.

SOUTHWARK.—The B.C. has accepted the following tenders :—

Siemens Bros.—40-KW. motor-generator and switchgear for supply of alternating current to premises in Chapter Road, £122.
British Insulated and Helsby Cables, Ltd.—440 yds. of 1 L.T.T.C. cable, £97.
Reavell & Co.—An air Compressor, £54.

The tender of the Corona Lampworks, Ltd., of St. Pancras, has been accepted for the whole of the metal-filament lamps for the Queen's Theatre, Shaftesbury Avenue.

**Mansfield.**—The Education Committee has accepted the tender of the Mansfield Engineering Co., at £40, for installing the electric light at Carter Lane Schools.

**North Ormesby.**—The U.D.C. has accepted the tender of Messrs. Baker Bros., of Stockton-on-Tees, for the installation of fire alarms, at £68.

**Sheffield.**—The City Council has accepted the tender of the British Thomson-Houston Co., Ltd., for 50 R.G.E. traction motors, at £100 each, for the Tramways Department.

**Sherburn.**—The P.C. has accepted the tender of Messrs. Haydn Harrison for 36 250-volt 50-C.P. Osram lamps.

**Sunderland.**—The T.C. on 13th inst. accepted the following tenders :—

Sunderland Forge and Engineering Co.—Re-insulating commutator of one 350-KW. rotary converter.
Ralph Nesbit & Co., Newcastle.—Treating with preservative compound four cooling towers at Hylton Road electricity works.
Isler & Co.—Spare parts for air-compressor machine at Hylton Road electricity works.
British Insulated and Helsby Cables, Ltd.—Cables for Roker Baths Road extension and stock.

**Warrington.**—The Education Committee has accepted the tender of Mr. H. Bibby, at £344, for electrical installation at the new Evelyn Street Council school.

**Waterloo.**—The U.D.C. has accepted the tender of Messrs. Harold Leake & Co., of St. Annes-on-Sea, at £421, for the electric light installation at the secondary school.

## FORTHCOMING EVENTS.

**Electrical Exhibition—Olympia.**—Friday, September 22nd. At the Trocadero. At 7.30 p.m. Inaugural banquet.
Saturday, September 23rd.—At 2 p.m. Opening ceremony at Olympia.

**Junior Institution of Engineers.**—Tuesday, September 26th, at 6.30 p.m. Visit to the Electrical Exhibition at Olympia, under the guidance of members of the Committee.

## NOTES.

**Educational Notes.**—NORTHERN POLYTECHNIC INSTITUTE.—The Prospectus for the session 1911-12 has been issued; the new engineering session started on September 20th, under Mr. H. Ade Clark, Wh. Sc.

SOUTH-WESTERN POLYTECHNIC INSTITUTE.—The Calendar of this Institute has been issued, and gives full particulars of the day and evening courses offered in Electrical Engineering, of which department Mr. A. J. Makower is the head. Students may prepare for the degree in Engineering of the University of London at this Institute, which also possesses a great variety of electrical plant and apparatus for practical work. The new term begins on Monday, October 2nd (day classes) and September 25th (evening classes), and a wide range of electrotechnology is dealt with in the various courses scheduled.

NORTHAMPTON POLYTECHNIC INSTITUTE.—The book of "Announcements" for the session 1911-12, which has just been issued, gives information regarding the day and evening courses in Engineering (Mechanical and Electrical), Electrochemistry, Technical Optics, &c.; courses are provided in Automobile work, Aeronautics and Radiotelegraphy. The day courses commence on Monday, October 2nd, the evening courses on September 25th. The new electrical generating station, which we described in our issue of October 21st, 1910, is now in operation. In the Technical Chemistry and Horological Departments morning classes have been instituted for apprentices, who spend the afternoons in their employers' workshops; this is a novel experiment, the results of which will be awaited with interest. Dr. R. M. Walmsley is the principal and head of the Electrical Engineering Department, associated with him in the latter function being Mr. F. M. Denton. Special lecturers are Mr. E. K. Scott, Dr. J. Erskine-Murray, Mr. J. H. Stephens and other experts in various lines.

UNIVERSITY COLLEGE, LONDON.—The prospectus of the Faculty of Engineering for 1911-12 has been published, and gives full particulars of the curricula drawn up for the different branches of engineering, including the diploma and degree courses. Special courses can also be arranged for. Prof. J. A. Fleming is Dean of the Faculty, and Prof. J. D. Cormack Vice-Dean. Information is included with regard to the social advantages available at the College, and to the numerous Scholarships open to candidates. Prof. Fleming is the head of the electrical engineering department, with Assistant-Prof. W. C. Clinton, and Mr. E. K. Scott is the lecturer on electrical design.

KING'S COLLEGE, LONDON.—The new session opens next month; courses of study are provided in Civil, Mechanical and Electrical Engineering, the last-named being under the direction of Prof. Ernest Wilson, and facilities are given for preparation for the engineering degrees of the University of London, as well as the Diploma and Certificate of the College. Special advanced lectures and courses have been arranged for, of which some particulars are given in our advertisement pages to-day.

**Hackney Electricity Staff Outing.**—The first annual outing of the staff and employés of the Hackney Electricity Works took place on Saturday last, the day being spent at Brighton. The party numbered 52. The weather was ideal. Dinner was served at "Mutton's" Hotel, the borough electrical engineer, Mr. L. L. Robinson, being in the chair, supported by the Mayor of Hackney, whose presence showed his keen interest in anything affecting the social well-being of the employés of the Council. The toast of "Our Guest, the Mayor," proposed by the chairman, was received with musical honours. "No speeches" was the order of the day, but in a few words the Mayor remarked that such an occasion must tend to the smooth working of the electricity undertaking. After tea the party returned to London, everybody feeling indebted to Messrs. Chas. Lill and F. Heathman for their efforts in making the outing so successful.

**Some Effects of the Strike.**—So much has been said and written on strikes during the last month, that we are almost constrained to apologise to our readers for referring to the subject again; but as actual examples of the untoward effect of blind obedience to the call of the paid agitator are not often brought into the light of day, we think it right to refer to a case which is reported in the *Times* of September 18th. Two boys were charged with begging at the City Juvenile Court. The father of one of them had been earning £3 a week as a printer. He was now being paid 18s. a week by the Union for picket duty. "The home," said the London County Council official, who gave evidence, "was in a terrible state of poverty. Five children, boys and girls, slept in one bed, with no covering. Nearly all the furniture had been disposed of." The father, giving evidence, said that belonging to

the Union he was forced to come out against his better judgment. He had no desire to strike. The home of the other lad, which was once comfortable and happy, containing amongst other luxuries a piano, now had nothing in it but the beds. Comment on these facts is needless. To use the words of the Alderman, "the persons most to blame for such suffering were not the weak-minded individuals who threw away their employment, but the leaders who induced them so to act." Truly the plight of the workman is pitiable when beset by his Union. If he remains faithful to his employer he is probably prevented from getting to work by the pickets. If he does what the Union requires, he forfeits his job, receives less than a third of his usual pay, and has no fixity of tenure in the contemptible occupation of a picket.

**Electrical Fatality.**—An inquest was held on the 15th inst. at Benton Square, near Newcastle-on-Tyne, on the body of Hugh McKechnie, aged 38, who lived at Byker, Newcastle; he was killed while working at an electric cable line near Scaffold Hill, Benton Square, on Wednesday. It was stated that the deceased was employed by the British Insulated and Helsby Cable Co., and was working at the top of a pole which carried a line of cable, when apparently his foot came into contact with a live cable and he fell to the ground, a distance of more than 40 ft. Dr. Saunders, of Backworth, expressed the opinion that McKechnie had been killed by electric shock, and was dead when he fell. The jury found that deceased had been accidentally killed whilst following his employment.

**Institution and Lecture Notes.**—The Polytechnic, Regent Street, W.—A special course of 12 lectures on "Illuminating Engineering" is to be delivered under the supervision of Mr. Leon Gaster. Six are arranged for Tuesday evenings between October 31st and Christmas, and the others for Thursday evenings after Christmas, as follows:—

October 31st and November 7th (Tuesdays).—"Electric Lighting," by Prof. J. T. Morris, M.I.E.E.
November 14th and 21st.—"Gas Lighting," by Mr. J. G. Clark.
November 28th.—"Oil, Petrol-air Gas, Acetylene, &c.," by Mr. E. Scott Snell.
December 5th.—"Illumination and the Eye," by Dr. W. J. Ettles, F.R.C.S.E.
January 11th, 18th and 25th, February 1st, 8th and 15th (Thursdays) by Mr. J. S. Dow, B.Sc., A.C.G.S., on the following in the order stated:—"The Measurement of Light"; "Illumination and its Measurement"; "Shades and Reflectors"; "Daylight and Artificial Lighting Compared"; "Colour of Artificial Illuminants"; "Practical Lighting Problems."

The fee for the full course is 12s. 6d., or 2s. for a single lecture. All of the lectures will commence at 7.30 p.m.

South African Institute of Electrical Engineers.—At a meeting held on August 17th, at the S.A. School of Mines, Johannesburg, Mr. J. H. Rider presided, and extended a welcome to Prof. Buchanan, the newly-appointed Professor of Electrotechnics at the School of Mines. Mr. G. V. Adendorff read a paper on "Atmospheric Phenomena and their Relation to the Production of Over-voltages in Electric Transmission Lines." Dealing with the overhead grounded wire, Mr. Adendorff said it was found that good protection was in most cases secured by placing a grounded wire above each phase of the line, provided the wires were of good conductivity and were grounded at as many places as possible. To make the protection as complete as possible the wire should be grounded at every pole, and no expense should be spared in order to obtain a thorough and satisfactory ground. If the system of installing a grounded wire on either side of the line were adopted, the extra expense would be justified by the better protective results obtained. The whole question of atmospheric phenomena in that country was of such vast importance to the electrical engineer that a complete study of the whole subject should receive his careful consideration.

The Society of Engineers.—On Monday, October 2nd, at the Institution of Electrical Engineers, Victoria Embankment, W.C., a paper will be read on "The Necessity for Safer, Quicker and Cheaper Railways, with Some Proposals Therefor," by C. Reginald Enock, F.R.G.S.

Junior Institution of Engineers.—Commendatoré G. Marconi, D.Sc., LL.D., has been elected President of the Junior Institution of Engineers, in succession to Sir J. J. Thomson, F.R.S.

Institution of Municipal Engineers.—The third annual general meeting will be held at Windsor on Saturday, October 21st.

**Pickup v. Barton.**—At the Blackburn County Court on Monday, John Pickup, of Burnley, claimed from Thos. Barton, electrician, Blackburn, the return of two sets of Weston 3-ton chain pulley blocks, one set of Weston 2-ton pulley blocks, three steel joists, six hangers, two travelling carriages for blocks, or £10, their value, and £2 damages for wrongful detention. Defendant, it was explained, had a sale of machinery and plant effects, and the plant in question was re-sold to plaintiff. In the ordinary course, the plant should have been removed within a week, but an arrangement was arrived at whereby the plaintiff left it for a fortnight or a month, in order that it might be used for lifting purposes. Many efforts had been made to secure the plant, but without success. Defendant said he had never actually refused to hand over the plant. He wanted rent for storage. His Honour said it was not disputed that the goods belonged to plaintiff, and the question was merely one of costs on plaintiff's claim. A verdict was given for plaintiff for the return of the goods in seven days, or their value, £5 17s. 6d., together with £1 1s. damages and costs.

**Electrical Trades Union.**—On Saturday last the Western branch held a dinner and concert at its place of meeting, the Bush Hotel, Shepherd's Bush Green, W., in order to promote good fellowship in the trade and to celebrate the great progress of the union and the branch in particular during the past 12 months. After dinner the evening was devoted to music and song. Between the two halves of the programme, speeches were delivered by Mr. T. Philpot, London district secretary, and Mr. J. Kinniburgh, organiser, emphasising the necessity of combination of London's electrical workers, and asking all present not to rest till London possessed the strongest organisation in the world. Mr. W. J. Webb, secretary of the Western branch, was the recipient of many good wishes, but stated that what he had done was little compared with what he might do if electrical workers would communicate with him at 98, Coomer Road, Fulham. Two members had travelled from Bristol and Taunton respectively in order to be present. That was the spirit that would make London the centre of the electrical world.

**American Practice.**—As a comment on our "Hints to Manufacturers" in our issue of August 18th, we have received from the Crouse-Hinds Co., of Syracuse, New York, a catalogue bearing the unfamiliar title of "Panels and Cabinets." In this country we speak more of "switchboards" and "fuseboards," although for many years *board* has not formed the material on which the apparatus has been mounted. The manner in which cramped back-space is avoided in the examples illustrated is by the exclusive use of front connections—a method now largely used here also. The panels vary considerably from recognised British practice. In the first place, a single slab of slate carries both poles, and not only so, but the D.P. connections for each circuit are brought side by side, instead of being separated by the width of the board. Further, the bus-bars are vertical and the circuit fuse horizontal in all cases, the former being raised off the panel with bars to each circuit passing under them, an arrangement requiring considerable quantities of copper strip. Evidence of lower voltages of supply would appear from the prominence of the 125-volt boards and the absence of anything over 250 volts, even for three-wire work. Sweating sockets apparently are only provided for the mains. The list is a weighty one of 80 large pages printed in colour on glazed paper, but the illustrations of sundry fittings might be improved by showing one of the knife-switches in the "off" position, and by illustrating the interior of the "snap" switch instead of only its cover.

**Electric Time Service.**—A correspondent inquires whether, preparatory to undertaking the supply and control of a number of electric clocks from a central point on the basis of yearly rentals, it is necessary to obtain a licence from the Postmaster-General. It appears that the transmission of electrical clock impulses over wires has been held not to constitute an infringement of the Postmaster-General's telegraphic monopoly; a licence is therefore not required. If, however, the distribution is likely to be over a wide area—especially in London—it would be advisable for the distributor to notify the Post Office of his intention, in order to avoid future trouble. In some cases the Postmaster-General would no doubt be willing to lease wires on annual mileage terms for such purposes.

**Exhibition Functions.**—Among the events to be held in connection with the Olympia Electrical Exhibition are the following:—

Electrical Contractors' Association, meeting on October 2nd at Olympia.
British Electrical and Allied Manufacturers' Association, dinner at the Hotel Cecil, on October 12th.
Institution of Electrical Engineers, meeting at Olympia, probably on one of the Thursdays during the run of the Exhibition.

**New Bridge Opened at Paisley.**—The new bridge over the river Cart, at Carlile Quay, was formally opened on Friday last by Provost Muir Mackean. The bridge, which has a span of 93 ft., and is 10 ft. wide, is erected on the Scherzer rolling lift principle, and is raised entirely from one side by electric power. It is stated that this is the largest single-span lift bridge in Britain, and the only one of its kind in Scotland. Sir William Arrol & Co. were the contractors, and the cost was £2,240.

**International Congress of Applied Chemistry.**—In September next year the eighth International Congress will be held at Washington and New York, U.S.A.; the final rules to be observed by contributors of papers will be issued in December next. Particulars can be obtained from the Secretary of the Congress at 25, Broad Street, New York, U.S.A.

**Explosion.**—An electrician named Munro, employed by the Clyde Valley Electric Supply Co., was injured by a gas explosion at Uddingston, near Glasgow. Several electricians, it seems, were examining manholes, and the gas in one of them came in contact with an acetylene lamp two yards away. The flames rose to a height of 16 ft., and a number of bystanders had narrow escapes.

**Fatalities.**—Mr. Philip Arthur Edmundson, aged 28, electrical engineer in the service of the Cornwall Electrical Power Co., was drowned while bathing at Lelant in a heavy sea. At an inquest on Monday the jury returned a verdict of "Accidental Death." The deceased had been in the employ of the company about a year.

**The Contractors' Association and Marylebone.**—The *Standard* states that the Central Board of the Electrical Contractors' Association has instructed the Law and Parliamentary Committee to proceed with an action against the Marylebone Borough Council on the question of competitive trading. It is added that the case will be proceeded with when a somewhat similar case at Dulwich has been concluded.

**B.A. Report on Electrical Standards.**—Mr. A. P. Trotter informs us that his name has been attached to the report of the British Association Committee on Practical Standards for Electrical Measurements, without his authority, and doubtless as the result of a mistake. But it compels him to state that he withdrew from the Committee in July, 1910, because he strongly disagreed with some of their resolutions, and with the mode in which their business was carried on.

The list of names of members of the Committee was, of course, printed as it came to us from the Association.

**Our Royalty and Electricity.**—The *Times* says that King George's new six-cylinder Standard landaulette for the Indian Durbar will be equipped with a generating plant for electric lighting.

The American *Electrical Review* says that the General Electric Co. (U.S.A.) has just finished an electric fan for Queen Mary. "It will be used to dry her hair after a shampoo. The fan is mounted in gold and has an ebony switch. It was specially designed to be in keeping with the Royal toilet articles."

**A Curious Breakdown.**—The designers and erectors of electric power plant machinery sometimes come across unexpected difficulties which entirely upset their calculations and for a time are quite baffling. This is the reason for that cryptic item which is often (and should always be) found in even the most finely cut estimate, labelled "contingencies." Even in the most standardised schemes it is nearly always the case that something will go wrong and will have to be put right by the contractors before the plant is taken over by the purchaser. An interesting case which illustrates this point may be narrated. A small alternating-current power house had been erected, the alternators being direct coupled to horizontal medium speed steam engines; the coupling was at one end of the crankshaft, and a small fly-wheel at the other. It was expected that the fly-wheel plus the weight of the rotating part of the alternator (the field) would be sufficient to reduce the cyclic variation of the sets sufficiently to give smooth parallel running. The arrangement adopted had been used before, and the makers both of the engines and the alternators were good firms. Curiously enough, however, after the station had been put into parallel running, there was not a great lapse of time before one of the crankshafts broke right across, and the indications of the fracture were those of severe torsional stresses. A new shaft was put in, but failed some little time afterwards, and a third shaft broke in exactly the same way. The matter was then very carefully looked into, and it was found that the engine builder, who had originally standardised his engines with wrought-iron crankshafts, had afterwards followed modern practice by using mild steel. This was, of course, quite in order, but the point had been overlooked that mild steel is far more subject to "fatigue" than wrought-iron. The continual torsional effects produced by the parallel running of the alternators and the consequent variations of effort on the crankshaft between the fly-wheel end and the coupling end had produced a certain amount of crystallisation in the material, finally resulting in a fracture. The point is very apt to be overlooked that wrought-iron, although very largely superseded by mild steel, still has its uses. We have often pointed out that the fly-wheel should invariably be placed between the engine and the generator, and the object lesson conveyed by this example may serve as a warning to those engine builders who persist in following the practice which we have condemned.

**Appointments Vacant.**—Lecturer in electrical costs and quantities, one evening per week, for the Battersea Polytechnic. Switchboard attendant, for the Erith Council Electricity Department (10s. to 15s.). See our advertisement pages in this issue.

## OUR PERSONAL COLUMN.

*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* ELECTRICAL REVIEW *posted as to their movements.*

**Central Station Officials.**—The Walsall Electricity Committee has placed on record its satisfaction at the ability and energy displayed by MR. ASHTON BREMNER during the period of six months in which he has been acting electrical engineer of the electricity undertaking of the Corporation, and the manner in which he has discharged, under trying circumstances, the numerous duties devolving upon him during the absence (owing to illness) of the borough electrical engineer.

The Dewsbury T.C. has appointed MR. F. H. SOUDEN, of Castleford, as mains assistant.

MR. R. J. ROSSER, assistant city electrical engineer of Cape Town, was to leave Cape Town for England on September 4th (by ss. *Buluwayo*) for a six months' holiday. After visiting the Electrical Exhibition at Olympia he will proceed to the Continent and to America to have a look round.

MR. H. R. HARPER, city electrical engineer of Melbourne, Australia, left this country for New York and Melbourne on Saturday last

**Tramway Officials.**—MR. HARRY PILLING, superintendent of the mechanical and electrical department of the Accrington Corporation, has been appointed manager of the electrical tramways, at a salary of £200 per year. The retiring manager is Mr. James Wilson. Mr. Wilson had expressed a wish to retire, and in consideration of his services during the transfer of the undertaking from the old company, he was granted one year's salary in lieu of notice and payment of £50 a year for the next four years as a consultative fee for his advice. It was stated that other changes would be carried out under the advice of the new manager, and it is expected that the rearrangements will effect an economy of about £500 a year.

**General.**—MR. PHILIP KEMP, M.Sc.Tech., has been appointed lecturer in electrical engineering at the East London College (University of London), in succession to Mr. L. Murphy, who has resigned to take up the position of managing engineer to the Perry Barr Fan Works, Birmingham. Mr. Kemp, after a distinguished career at the Manchester Municipal School of Technology, spent two years at Messrs. Mather & Platt's works in the testing department, designing room and drawing office. Since then he has had two years of teaching experience in electrical design and laboratory classes, under Prof. Schwartz. He was awarded in 1910 the "Joule" Medal for a paper on "Some Thermo-Dynamic Properties of Rubber," and is a joint author of a paper printed in the *Journal* of the I.E.E. on "The High-Tension Spark Discharge in Air."

The staff of Messrs. Siemens Bros., Stafford, have presented a silver afternoon tea service to DR. KLOSS, who is leaving to take up a University Professorship in Germany.

MR. J. H. BUTTERS, B.Sc., A.M.I.E.E., has been appointed to the position of chief engineer to the new Hydro-Electric Power and Metallurgical Co., Ltd., of Tasmania, and manager of their hydro-electric supply. Mr. Butters served as apprentice with Messrs. Thorneycroft & Co., Ltd., leaving them to join Messrs. Siemens Bros. Dynamo Works, where he held the position of designing engineer, and was in charge of the estimating design department at their Stafford Works, being later transferred to the head office as central station and power engineer. Two years ago he was appointed to the position of engineer to the firm's Australasian branch, which position he has now resigned to take up his new appointment. Mr. J. H. Gillies, the managing director of the new company, is now in London. Mr. Butters is proceeding immediately to Tasmania to lay out the work and to prepare specifications for the large machinery which will be necessary to carry on the new company's work.

MR. T. A. EDISON is in Europe at present, and while motoring near Nuremberg on Sunday evening he had the misfortune to run over and kill a 12-year old boy.

MR. JAMES STRACHAN has resigned the position of works manager, which he has held for the last three years with Messrs. Tetley & Co., Salford, and is now manager of the works of the Salford Electrical Instruments, Ltd., North George Street, Salford.

MR. H. R. ABBOTT, of the Electric Maintenance Department at the Neasden Works of the Metropolitan Railway, is leaving the company to take up an appointment as workshop and car-shed superintendent with the Ceylon Tramway and Lighting Co.

**Obituary.**—The death has occurred at his residence at Wadhurst, Sussex, of Mr. Rayner, a director of Maplé & Co., Ltd., electrical contractors, &c., of Tottenham Court Road, London. Deceased was a native of Ashford, Kent, and had been with the firm almost all his life.

According to the *Evening Standard* HERR ADOLF SCHWIEGER, a director of the Siemens-Schuckert and Siemens & Halske Works, and a pioneer of electric railways, has died at Wiesbaden, aged 66.

The electrical trade friends in the West of England and South Wales of MR. HARRY NANCE, of Cardiff, will learn with regret of the death of his wife at the early age of 24 years.

## CITY NOTES.

### National Electric Construction Co., Ltd.

THE annual meeting of this company was held at the offices, 3, Laurence Pountney Hill, E.C., on Wednesday, September 13th, Mr. L. B. Schlesinger presiding.

The report submitted for adoption was as follows:—

"The gross profit for the year to December 31st, 1910, is £11,456, and deducting therefrom expenses of administration, debenture

interest, &c., there remains a balance of £1,028, plus £6,322 brought forward, making a total of £7,350. This amount is to be dealt with as follows: Transfer to debenture redemption fund £1,550, depreciation on free wired installations £361, rolling stock, &c., Dewsbury and Ossett Tramways, £208, furniture, fixtures, plant and tools £75; carry forward £5,156.

"Attempts to finance new electrical undertakings in this country meet with little response, and tramway construction work, excepting extensions, has practically come to an end. The negotiations for an important contract abroad, to which reference was made in the last report, are approaching completion, and it is expected that an agreement will be concluded in the near future. Other foreign contracts of considerable magnitude are in course of negotiation. Since the close of the year the overdraft at bank has been reduced from £38,386 to £5,480, and special loans from £22,500 to £10,000. The undertakings in which the company is interested continue to show progress."

Rhondda Tramways Syndicate.—The profit earned for the year was satisfactory, a divident of 6 per cent. on the capital of the syndicate being paid after placing a substantial amount to reserve. Since the close of the year the syndicate has sold its holding of £200,000 5 per cent. debentures in the Rhondda Tramways Co., Ltd., on satisfactory terms. The syndicate is now in liquidation, and a cash distribution of 55 per cent. has already been made to its shareholders.

The Rhondda Tramways Co., Ltd., is about to carry out extensions, and arrangements for the finance are in course of completion. The contract, amounting to about £84,000, will be placed with your company.

Mexborough and Swinton Tramways.—The profit earned by this undertaking for 1910 showed a substantial increase over the profit for the previous year, and it is satisfactory to note that the receipts for the current year show a marked increase over those for the corresponding period of last year.

Musselburgh and District Electric Light and Traction Co., Ltd.—The Port Seton extension was in operation for a complete year. A substantial increase in the profits was obtained, allowing a dividend of 6 per cent. on the preference share capital to be paid.

Torquay Tramways.—The overhead system has been installed, and has been working since March 17th, 1911. The change from the surface-contact system has resulted in a large saving in both current and maintenance. The extension to Paignton was opened on July 17th, 1911, and the receipts from that date on the whole system have been in accordance with the estimates.

Oxford Electric Tramways.—Owing to the financial conditions prevailing, it has been impossible to carry out the electrification of this system, but the horse tramways are working at a profit which allows of a dividend on the syndicate's capital.

Dewsbury and Ossett Tramways.—After providing for sinking fund and interest payments to the local authorities, who provided the capital, this system shows a profit of £361 for 1910, which compares with a loss of £329 14s. on the previous year's working. There is a substantial increase both in receipts and profits from January 1st to date.

Town Lighting Installations.—These undertakings continue to make progress.

At Bo'ness an important contract has been settled for the supply of electric power, which has been taken from June, 1911. The 8-c.p. lamps connected at Bo'ness now number 21,894, as compared with 21,810 last year; and at Carnarvon 15,459, as compared with 13,651.

The CHAIRMAN, in moving the adoption of the above report, said an explanation was due for holding the meeting so late. It was intended to hold the meeting in June, but about the same time the negotiations for an important contract appeared to be nearing completion, and the directors thought it advisable to postpone the meeting for a few weeks in the hope that they would be able to report at the meeting that the contract had been concluded. The contract was for the construction of an electric railway on the Continent, the capital for which was being guaranteed by some 30 authorities. They disposed of all their competitors a long time ago and knew that, if the scheme went through, the contract would go to the company. The delay had been entirely due to the difficulty these authorities had had in settling among themselves their various interests, but he was happy to inform the shareholders that they were now all in agreement and had signed the petition to the Government to authorise a Joint Board or some such authority to be formed. According to a cable they had received recently, the Government had advised a deputation that the powers would be granted without delay. Their engineer had already met the consulting engineer and the Committee and agreed upon the prices for the construction work, but he would hardly like to make any definite statement as to the date when the business would be concluded. The contract was not so large as contemplated, the scheme having been cut down. It would be for about £50,000, but it was probable, before it was finished, extensions would be taken in hand, so that the final scheme might reach the figure they first discussed. In addition to this contract, they were interested in several tramway propositions abroad. In one case, a group had paid a substantial deposit, and they had an arrangement with this group that, if the finance was arranged, the contract would be carried out by the company. The contract would run into £450,000. Their engineer had been abroad investigating tramway propositions at the expense of the group, the condition being that if any schemes were taken up they were to have the contracts. They had just completed an extension of the Torquay tramway to Paignton. This was opened in July last. The chairman then proceeded to quote from the report as to the progress made by the Rhondda Tramways Syndicate, Mexborough and Swinton Tramways, Musselburgh and District Electric Light and Traction Co., Ltd., Torquay Tramways, Oxford Electric Tramway and Dewsbury and Ossett Tramways, in all of which the company is interested. Coming to the profit and loss account, he said the expenditure was £5,991, as compared with £5,814 for last year; the debenture interest was the same as last year. The directors' fees amounted to £300, the balance being waived. Auditors £76, as against £105 last year. Expenditure on contracts which had fallen through amounted to £130, as compared with £86 last year. The gross profit for the year was £11,456, and deducting therefrom expenses of administration, debenture interest, &c., there remained a balance of £1,028. To this had to be added £6,322, the balance carried forward at December 31st, 1909, making a total of £7,350. The directors recommended that this amount be dealt with as follows:—Transfer to the debenture redemption fund, £1,550; depreciation on free wired installations £361; rolling stock, &c.; Dewsbury and Ossett Tramways, £208; furniture fixtures, plant and tools, £75; and to carry forward £5,156. As a result of the disposal of Musselburgh securities and the return of a substantial part of their capital in the Rhondda Syndicate, the revenue from this source would be down this year. On the other hand, with the Torquay tramway undertaking now in working order, they should get some return on that. The expenditure on tramways and lighting concessions stood at £54,573, compared with £51,549, the increase being due to the Parliamentary expense incurred in connection with the Folkestone and Oxford Tramways. The directors were satisfied that their organisation for construction work was thoroughly efficient in every way. In conclusion, he said that they had a tramway proposition in this country which did not require a great deal of capital, and which they would shortly ask their shareholders to support financially. He was satisfied that it was an undertaking which would do well, and it meant a contract for the company. He referred to the Aldershot Light Railway, the total capital required being about £84,000. They were now forming a syndicate with a capital of £84,000.

MR. CARR SAUNDERS seconded the motion, and the report was adopted.

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**Dick, Kerr & Co., Ltd.**—The report of the directors for the 12 months ended June 30th last, states, according to the *Financial News*, that the profits earned amount to £37,994. Out of this have had to be paid debenture interest and trustees' fees, and there has been reserved the sum required to provide for the premium payable on the redemption of the present debenture stock. These items absorb £12,060, leaving a balance of £25,933, to which must be added the profits brought forward from last year, viz., £42,258, making a total of £68,191 available for appropriation as follows: To pay a dividend of 6 per cent. per annum on the preference share capital (the proportion of this dividend to December 31st, 1910, has already been paid), absorbing £18,300; to pay a dividend of 5 per cent. on the ordinary share capital of £260,000 (to be paid less income-tax), £13,000; and to carry forward the balance of £36,891. Notwithstanding the continued competition in all branches of the business during the past year, the directors state that they are pleased to submit accounts which show considerable improvement in comparison with the two preceding years.

**Continental.**—FRANCE.—La Société de Constructions Electriques, of Nancy, is declaring a dividend of 5 per cent. for the last financial year, the same as for the preceding 12 months. It is proposed to increase the capital of the concern from £40,000 to £80,000.

**Shawinigan Water and Power Co.** — A quarterly dividend of 1¼ per cent. is announced.

**Stock Exchange Notices.**—The Committee has ordered the undermentioned securities to be quoted in the Official List:—

Hastings and District Electric Tramways Co., Ltd.—268,235 ordinary shares of 10s. each fully paid, Nos. 130,001 to 398,235; and 80,000 6 per cent. cumulative preference shares of £1 each fully paid, Nos. 1 to 80,000, partly in lieu of the preference shares of £5 each now quoted.

Melbourne Electric Supply Co., Ltd.—20,000 7 per cent. first cumulative preference shares of £5 each fully paid, Nos. 30,001 to 50,000.

Rio de Janeiro Tramway, Light and Power Co., Ltd.—Further issue of £400,000 5 per cent. 50-year mortgage bonds of £100 each, Nos. B23,501 to B27,500.

**Hove Electric Lighting Co., Ltd.**—The directors have declared an interim dividend on the ordinary shares of the company at the rate of 8 per cent. per annum for the six months ended June 30th last, payable October 16th next.

**Gateshead and District Tramways Co.**—The directors have resolved to pay the usual half-yearly interim dividends on the 5 per cent. and 6 per cent. preference shares on September 30th, and on the same date to pay an interim dividend on the ordinary shares for the half-year ended June 30th, 1911, at the rate of 5 per cent. per annum.

**Metropolitan Electric Tramways, Ltd.**—The directors have declared an interim dividend on account of the year 1911 at the rate of 6d. per share (less income-tax) on the ordinary share capital, payable on October 16th.

**Yorkshire Electric Power Co.**—The report of the directors (as summarised in the *Times*) states that the gross profit for the half-year ended June 30th, was £6,633, as against £4,950. The net profit, after deduction of mortgage interest, amounted to £4,137, as against £2,622. There has been a general increase in the sale of energy to all classes of consumers. The balance available at June 30th last was £13,613, and the directors recommend a dividend, less tax, for the half-year, of 6 per cent. per annum on the amount paid up on the cumulative preference shares, carrying forward £12,477. Applications for 6 per cent. cumulative preference shares continue to be received, and at the date of the report, July 18th, over £83,000 has been applied for out of the £100,000 authorised.

**Calcutta Electric Supply Corporation, Ltd.**—The number of units delivered to consumers during the four weeks ended July 28th, 1911, were 912,348, compared with 794,120 in the corresponding four weeks of 1910. The units delivered during the four weeks ended August 25th, 1911, were 968,863, compared with 824,917 units in the corresponding four weeks of 1910.

**Bank Rate.**—The Bank Rate was yesterday raised from 3 to 4 per cent.

## Anglo-American Telegraph Co., Ltd.

In calling an extraordinary general meeting for September 29th, the directors state that the conditional agreement between this company and the Western Union Telegraph Co. for the purchase by this company of the Western Union Co.'s new trans-Atlantic cable and its equipment at a cost of about £700,000, and for the lease of the whole of this company's cables, properties and business to the Western Union Co., has been exchanged.

"If the stockholders of both companies confirm the agreement by the prescribed majorities, and the Court sanctions the necessary extension of the Anglo Co.'s memorandum of association, the result will be that, by means and subject to the conditions of the lease, the Anglo Co. will for 99 years be guaranteed a rent equal to dividend at the following rates on its total capital of £7,000,000 :—On the preferred stock, 6 per cent. per annum ; on the ordinary stock, 3¾ per cent. per annum ; on the deferred, 1½ per cent. per annum. The agreement for lease has been reached after much negotiation and consideration of the legal difficulties and under the advice of eminent English and American counsel. In view of the more stringent enforcement recently in America of the Sherman Anti-Trust Act, the Western Union Co. became concerned as to its position under the pooling and working agreements of 1882, and at length notified the Anglo Co. that on and after March 1st, 1911, it would not accept the penal and personal consequences of the Anti-Trust Act, and must treat these agreements as illegal and withdraw from the pool. The company's American counsel has advised that, whilst it is impossible in the present state of the decisions to pronounce with certainty upon the validity of the agreement now entered into, he is of opinion that the proposed lease is good under the American common law, and would not be held to be in violation of the Anti-Trust Law. The reports of the Western Union Co. show that its profits, after paying its own working expenses and fixed charges, amount, on an average over the last 10 years, to upwards of £1,000,000 per annum. After the lease is executed, fewer directors will be needed. Several members of the present board will then retire, and the stockholders will be asked to vote £4,000 by way of compensation to those who do so, to be divided between them as they think fit. At least three will remain to look after the shareholders' interests under the lease. Cables cost less now and rates are lower than when your predecessors became the pioneers of Atlantic telegraphy. Moreover, a considerable part of the Anglo Co.'s large capitalisation of £7,000,000 must be regarded as 'dead,' since it represents money sunk in early attempts to bridge the Atlantic. Notwithstanding, the rent under the proposed lease is 3¾ per cent. per annum upon the whole capitalisation. Your directors recommend you to approve the agreement, and to cover by means of a lease at a fixed rental the various risks inseparable from cable property."

The resolutions to come before the meeting are :—

1. That the conditional agreement dated August 22nd, 1911, and made between this company of the one part and the Western Union Telegraph Co. of the other part, which has been laid before this meeting, be and the same is hereby sanctioned and approved, and that the directors be and they are hereby authorised to carry such agreement into effect in due course subject to such modification (if any) as they may from time to time approve.

2. That the provisions of the memorandum of association of the company with respect to the objects of the company be altered by the addition at the end of Clause 3 of the said memorandum of the following words, that is to say :—

"And in addition to the above, to enter into and carry into effect, enforce, modify or determine agreements for the purchase of trans-Atlantic telegraph cables and every other kind of property, whether real or personal, and leases of and agreements for leasing at such rent and upon such terms and conditions as may be deemed expedient the whole or any part of the property, goodwill and assets of the company, and in particular

"(a) To enter into and carry into effect (with or without modification) an agreement dated August 22nd, 1911, between this company and the Western Union Telegraph Co. for the purchase by this company of one of the trans-Atlantic telegraph cables of the Western Union Telegraph Co. and its equipment, and for the grant by this company to the Western Union Telegraph Co. of a lease (at the rent and on the terms and conditions in such agreement appearing) of the whole of the property, goodwill and assets of this company in so far as the same are capable of being leased (except as in such agreement mentioned) and relating to the other matters in the said agreement mentioned.

"(b) To effect the purchases, make the payments, grant (with or without modification) the lease and execute and do all acts and things whatsoever which by the said agreement (with such modifications thereof, if any, as may hereafter be agreed upon) are, or ought, to be effected, made, granted, executed and done by this company.

"(c) To enforce and determine the said agreement, and the lease to be granted in pursuance thereof, or either of them, with such modifications (if any) thereof respectively, as may, for the time being, subsist ; and

"(d) generally to do all acts and things whatsoever which may be considered necessary, conducive or incidental to carrying into effect, with such modifications (if any) thereof respectively as may hereafter be agreed upon, the aforesaid agreement and lease, or either of them, or to enforcing or determining such agreement and lease, or either of them, with such modifications (if any) thereof respectively as may for the time being subsist."

3. That upon the said conditional agreement, dated August 22nd, 1911, becoming operative (with or without modification), and any present directors of the company retiring within three calendar months after the same becomes operative, there be paid out of the funds of the company to the said directors who so retire the sum of £4,000, such sum to be divided amongst such retiring directors in such proportions as they may agree.

## Direct United States Cable Co., Ltd.

The directors' report for the half-year ended June 30th, states that the revenue, after deducting out-payments, amounted to £46,230, as compared with £58,556 for the corresponding period of 1910, a decrease of £12,326. This falling off in receipts is due to the Western Union Telegraph Co. having departed from the arrangement that has been in force since 1882, by withholding traffic collected by that company in America which has hitherto been transmitted over the cables of the Anglo-American Telegraph Co., Ltd., and of this company. The working and other expenses during the six months, including income-tax, amounted to £27,749, as compared with £25,277 in the corresponding six months in 1910, an increase of £2,472, which is accounted for by expenses at the Harbour Grace Station, established in the latter part of last year, and which appear now for the first time in the accounts. The reserve fund account, after being debited with the cost of maintenance of cables, balance of expenditure on fire extinguishing plant at Ballinskelligs Station, expenditure in connection with the diversion of the cable to Newfoundland, and the transfer to revenue account of a sum of £7,168 (to provide for the dividend and bonus paid on July 31st, 1911), and being credited with interest on the investments and profit on sale of securities, stands in the accounts at a sum of £512,323, as compared with £533,024 at June 30th, 1910, showing a decrease of £20,701. If, however, the expenditure of a capital nature upon the company's properties, and in connection with the diversion of the cable, amounting to £31,204, which has been charged to the reserve fund account during the year, be taken into consideration, it will be seen that a sum of £10,503 has been added to the reserve fund account during the year, after charging against it the cost of maintaining and renewing the cables. As the result of negotiations extending over many months, an agreement, of which particulars accompany this report, has been provisionally entered into by the directors with the Western Union Telegraph Co. This agreement is to be submitted to the shareholders at an extraordinary general meeting to be held at the conclusion of the sixty-eighth ordinary general meeting on Friday, September 29th. The negotiations were in progress in July, when the final accounts have hitherto been issued, but in the circumstances the directors considered that it was not in the interests of the shareholders then to issue them. They, therefore, deferred the publication of the accounts, paying a dividend and bonus for the quarter to June 30th last at the same rate as for the corresponding quarter in 1910. Thus, a dividend of 4 per cent., with a bonus of 1 per cent., making 5 per cent. in all, was paid to the shareholders during the past financial year.

In a circular which accompanies the above report, the directors state shortly the effect of the more salient provisions of the agreement, a copy of which will be produced at the office of the company to any shareholder who desires to see it. The agreement provides that this company shall lease to the Western Union Co. for a term of 99 years, dating as from April 1st last, its cables, telegraph lines, offices, landing places, plant, stores, &c., at an annual rental of £58,568. For the convenience of the Western Union Co., the term of the lease commences as from April 1st last. The rent from that date up to June 30th last has been agreed in account at the sum of £10,803, this sum being regarded as compensation to this company for the loss occasioned to it by the withholding of traffic by the Western Union Co., to which this company was entitled under the agreement of 1882 As from June 30th last the full rent of £58,568 becomes payable. In addition to the above rental the Western Union Co. agrees to provide the cost of the administration of this company's business, including rent of offices, &c., and also to pay all rates, taxes, charges, assessments and outgoings payable in respect of the leased properties. Further, the Western Union Co. agrees to make a contribution to the remuneration of the directors, and to maintain the value of this company's pension fund, so that it may be adequate to meet all subsisting and future liabilities. On the other hand, this company will retain its reserve fund, which now amounts to £512,323, and will remain responsible for the repair and renewal of the leased properties as hitherto, all other liabilities of this company being taken over by the Western Union Co. The agreement contains a provision that this company shall not be at liberty to pay a dividend of over 5 per cent. per annum without the consent of the Western Union Co. The agreement further provides that the proposed lease shall be construed and take effect as a lease made in England and in accordance with the laws of England. It will be appreciated, however, that the lessee, being an American corporation, will be subject to the laws of the United States of America, and if any question were raised as to the validity of the lease under the Sherman (Anti-Trust) Law it would have to be decided by the American Courts. The possibility of an unfavourable decision has been provided for by the insertion in the lease of a clause to the effect that if for any reason the lease should fail or cease to be binding upon the Western Union Co. that company shall nevertheless be bound at all times to give this company the same or as good connections, through service and facilities, as those which this company enjoyed in the year 1910 over the Western Union Co.'s landlines in the United States of America.

## STOCKS AND SHARES.

Tuesday Evening.

Under the influence of the rather more exhilarating Continental news in regard to Morocco, the Stock Exchange markets have cheered up in some small measure. True it is that the probability of a rise in the Bank Rate has forced Consols down to another record low level for the 2½ per cent. stock ; but, apart from the orthodox gilt-edged departments, investment securities are firmer, and there is certainly a little more disposition on the part of the investor and speculator to pay greater heed to the Stock Exchange.

At the same time, prices on balance are none too good, particularly in the Home Railway market ; there the liquidation has been especially severe. People bought far more stock than they could carry conveniently, either in the market or with their bankers, and it has been forced out in blocks at a time. The progress of the Railway Commission has afforded the market no assistance. From the evidence which has been given on both sides, it is considered that the companies will have to pay substantially more to their

employés in the near future. Nor have the echoes of the great strike entirely died away; they are still audible in Ireland, and in the present state of nervousness the fear exists that the epidemic may break out afresh.

Metropolitan Consolidated shows a further big loss of 1¾ on the week, and Districts are also ¾ down. In both cases the prices stand at nearly the lowest of the year, and although Metropolitans come into spasmodic favour, buyers at present seem unable to afford any stability to their market. An unpleasant feature is the way in which the company's prior-charge stocks are falling. East London receded to 4¼. Central Londons of all three classes have kept steady, for which it is suggested that the project to "ozonise" the air in the Tube at all the other stations in addition to the Bank, is to a great extent responsible. Incidentally, it may be observed that some travellers who were not aware of the new system have failed to notice much difference in the atmosphere at the Bank station. City and South Londons are steady at 29½. The suggestion of nationalisation of railways, which has been called into practical being by the strike events of last month, is not regarded as a bull point by the market; but although the proposition has certainly come nearer to the range of practical politics, its carrying-out is probably so many years away that it can scarcely be said to deserve painstaking consideration yet.

Sharp falls occurred in Rio Trams and Mexico Tramways in connection with financial trouble that developed in Brussels somewhat acutely at the end of last week. The price of Rio Trams was forced down to 112¼, from which it has since recovered to 115, leaving the price only slightly down on balance. Mexico trams were lowered at one time to 114, rebounding to 116, which shows a point loss on the week. Sao Paulo Tramway shares also gave way, though they have subsequently improved to 174½, which is *ex* the 2½ per cent. dividend deducted last Thursday. The trouble in Brussels led to the bonds as well as the shares being marked down. Besides the Continental difficulties, there was some apprehension of failures occurring in Glasgow and Edinburgh, in both of which centres the securities are popular for investment. Within the last day or two, however, these troubles are understood to have been arranged, and no open defaults have been reported, with the result that, as stated before, a good part of the fall has been recovered. Manaos Tramway Debenture is a point to the good. London United Tramways Preference have gone back ¼, and Dublins are ½ lower on the railway strike in Ireland.

The principal feature of the week, so far as concerns the stocks and shares with which we deal, is the publication of the agreement between the Anglo-American Telegraph Company and the Western Union Telegraph Company, which is to come before the shareholders of the former undertaking for confirmation on the 29th inst. The agreement provides for the same terms as have been announced before; that is to say, the Western Union guarantees a dividend of 3¾ per cent. on the Anglo-American Ordinary stock, which allows the Preferred 6 per cent. and the Deferred 1½ per cent. dividends. Of course, the knowledge that these terms would in all probability be finally accepted has led to the prices of the Anglo Company's issues discounting the actual event; and the only result of the agreement's publication has been to advance the prices of the Preferred and Deferred to a slight extent, while the Ordinary stock is ½ lower at 68, business having been marked on Monday 67.

Even now the desirable consummation cannot be called absolutely secure. It may be well supposed that the proprietors of the Anglo-American Company will accept the terms; but the doubt arises as to whether, under the Anti-Trust Laws of the United States, the fusion will be regarded as permissible. President Taft is this week on a stump tour, pledged to do all he can in the way of upholding Anti-Trust doctrines, and it would appear to be a dangerous policy for the Anglo-American Telegraph Company to agree to the proposals unless, when carried, they can be regarded as watertight. Direct United States shares, which are also interested in the agreement, are unchanged at 7½. Commercial Cable 4 per cent. Debenture stock at 88½ shows no change; it is understood that the company is on the warpath with opposition against the Anglo-American Western Telegraph fusion. Eastern Extension shares have not recovered from their slight drop of last week, and Eastern Telegraph Ordinary at 138½ can be bought to return a trifle over the round 5 per cent. on the money; there is a quarterly dividend pending on both next month. Westerns fell ¼, but West India and Panama are being bought again, and the price is 1/16 harder. Globe Ordinary show ¼ decline.

Marconi shares, after being strong at 47s. 6d., went back a little to 45s. 9d., and National Telephone issues are easier. The Deferred fell 2, and both classes of senior Preference shares ½ each. Reuter's shares are a good market, again showing a rise of ½. American Telephone and Telegraph capital stock gained a point, and the 6 per cent. certificates of the Submarine Cables Trust are higher to the same extent. Mackay Companies stocks of both classes are *ex* dividend.

The list of English Electricity Supply and Power shares is devoid of change so far as the London issues are concerned, with the solitary exception of Chelseas, where ½ fall is brought about by the dividend deducted last week. Oxfords are an equal amount lower for a similar reason. Miscellaneous shares are also very quiet. Edison & Swan fully-paid fell ½, but there has been rather more inquiry for British Westinghouse Preference, although the price shows no quotable change. Castner-Kellner's are again harder. Electric Constructions have come on offer, the price falling to 12s. 6d. middle. India-rubber shares put on 10s., there being very little floating supply of stock. The rubber share market is firm in consequence of the strength of the raw material; in fact, it is one of the few good markets round the Stock Exchange at the present moment.

## ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

| Locality. | Fortnight ended. | Receipts for the fortnight. | | No. of wks. | Total to date. | | Route miles open. | |
|---|---|---|---|---|---|---|---|---|
| | | £ | £* | | £ | £* | | Inc. |
| Aberdeen | Sept. 13 | 3,220 | + 252 | 15 | 24,900 | + 1,600 | .. | .. |
| Ayr | „ 16 | 641 | — 398 | 18 | 7,545 | — 305 | 8 | .. |
| Bath | „ 16 | 1,988 | — 7 | 37 | 31,870 | + 1,146 | .. | .. |
| Birkenhead | „ 17 | 2,293 | + 78 | 24 | 28,422 | + 1,088 | 13·7 | .. |
| Birmingham Corp. | „ 9 | 17,987 | +4,729 | 23 | 186,508 | +30,148 | 56·4 | .. |
| Blackburn | .. | .. | .. | .. | .. | .. | .. | .. |
| Blackpool Corp. | „ 14 | 6,772 | +1,862 | .. | 46,421 | + 6,137 | .. | .. |
| Blackpool-Fleetw'd | „ 18 | 3,627 | + 368 | 11 | 19,847 | + 1,639 | .. | .. |
| Bolton | „ 17 | 5,392 | + 218 | 25 | 63,825 | + 4,582 | 26 | .. |
| Bournemouth | „ 13 | 4,774 | + 394 | 24 | 47,505 | — 1,328 | 22 | .. |
| Bradford | .. | .. | .. | .. | .. | .. | 56 | 1·8 |
| Brighton | „ 17 | 2,611 | + 236 | 24 | 28,798 | + 2,045 | 9·5 | .. |
| Bristol | „ 15 | 14,215 | +1,535 | .. | .. | .. | .. | .. |
| Brit. Elec. Trac. Co. | | | | | | | | |
| Airdrie | „ 8 | 457 | — 18 | 36 | 7,837 | + 49 | 3·65 | .. |
| Barnsley | „ 8 | 370 | + 36 | „ | 6,642 | + 440 | .. | .. |
| Barrow | „ 8 | 803 | + 181 | „ | 11,077 | + 1,258 | 5·37 | .. |
| Devonport | „ 8 | 1,155 | + 202 | „ | 17,967 | + 2,690 | 8·85 | .. |
| Gateshead | „ 8 | 2,130 | + 107 | „ | 37,459 | + 2,123 | 11·25 | .. |
| Gravesend | „ 8 | 485 | + 36 | „ | 7,746 | + 242 | 6·5 | .. |
| Greenock | „ 8 | 1,699 | + 259 | „ | 23,284 | + 3,405 | 7·25 | .. |
| Hartlepool | „ 8 | 677 | + 64 | „ | 9,937 | + 848 | 6·72 | .. |
| Kidderminster | „ 8 | 296 | + 28 | „ | 4,410 | + 307 | .. | .. |
| ‡Leamington | „ 8 | 511 | + 154 | „ | 6,561 | + 483 | .. | .. |
| Merthyr | „ 8 | 436 | — 11 | „ | 7,576 | + 123 | 2·9 | .. |
| Metropolitan | „ 8 | 19,868 | +3,403 | „ | 318,526 | +50,185 | 22 | .. |
| Middleton | „ 8 | 729 | + 81 | „ | 12,608 | + 1,127 | 8·5 | .. |
| Mid. Joint Com'tee | „ 8 | 9,081 | —2,741 | „ | 199,910 | — 7,177 | .. | .. |
| Oldham—Ashton | „ 8 | 1,226 | + 44 | „ | 20,753 | + 777 | 9·13 | .. |
| Peterborough | „ 8 | 321 | + 67 | „ | 4,676 | + 497 | 5·31 | .. |
| Potteries | „ 8 | 3,911 | + 300 | „ | 69,163 | + 6,680 | 29 | .. |
| Rothesay | „ 8 | 754 | + 92 | „ | 8,790 | + 77 | 2·75 | .. |
| Southport | „ 8 | 758 | + 68 | „ | 11,380 | + 512 | 8·17 | .. |
| S. Metropolitan | „ 8 | 2,029 | + 313 | „ | 31,909 | + 1,999 | .. | .. |
| Swansea | „ 8 | 2,453 | + 105 | „ | 41,505 | + 2,518 | 12·5 | .. |
| Tynemouth | „ 8 | 782 | + 100 | „ | 10,312 | + 455 | 3·75 | .. |
| Weston-s-Mare | „ 8 | 906 | + 584 | „ | 6,982 | + 587 | 3 | .. |
| ‡Worcester | „ 8 | 743 | + 84 | „ | 10,837 | + 551 | 5·75 | .. |
| Wrexham | „ 8 | 218 | + 15 | „ | 3,660 | + 175 | .. | .. |
| Yorks. Wool. Dist. | „ 8 | 2,295 | + 223 | „ | 38,111 | + 2,799 | 17 | .. |
| Miscellaneous | „ 8 | 533 | + 46 | „ | 8,365 | + 480 | .. | .. |
| Burnley | „ 16 | 3,065 | + 224 | .. | .. | .. | 11·7 | 1 |
| †Burton-on-Trent | „ 10 | 292 | + 17 | 23 | 7,037 | + 641 | 10 | .. |
| Bury | „ 17 | 2,611 | + 104 | 24 | 32,583 | + 3,210 | 22·5 | .. |
| Cardiff | „ 9 | 5,121 | + 162 | 23 | 59,692 | + 5,308 | .. | .. |
| Chatham and Dist. | „ 14 | 2,003 | + 157 | 37 | 32,041 | + 467 | 15 | .. |
| Cork | „ 14 | 1,223 | + 96 | 37 | 18,846 | + 601 | 9·9 | .. |
| Croydon | „ 8 | 3,764 | + 444 | 22 | 43,955 | + 3,869 | .. | .. |
| †Darlington | „ 9 | 232 | + 20 | 24 | 5,368 | + 554 | .. | .. |
| Darwen | „ 15 | 599 | + 40 | 24 | 6,672 | + 583 | 4·26 | .. |
| Dover | „ 9 | 693 | + 133 | 23 | 6,591 | + 1,036 | 4·75 | .. |
| Dublin | „ 15 | 12,405 | + 871 | .. | 77,806 | +10,410 | 54 | .. |
| Dundee | „ 13 | 2,579 | + 111 | 17 | 21,095 | — 286 | 15 | .. |
| East Ham | „ 16 | 3,008 | + 208 | 24 | 26,888 | + 1,455 | 7·9 | .. |
| †Exeter | „ 15 | 381 | + 29 | 24 | 9,008 | + 772 | 5·5 | .. |
| Glasgow | „ 16 | 40,726 | +2,928 | .. | 292,001 | +19,340 | 98 | ·75 |
| Hastings | „ 14 | 3,123 | + 363 | .. | .. | .. | .. | .. |
| Huddersfield | .. | .. | .. | .. | .. | .. | .. | .. |
| Hull | „ 16 | 5,692 | + 491 | 24 | 69,162 | + 3,451 | 14·5 | .. |
| Ilkeston | „ 14 | 279 | + 11 | 24 | 3,275 | + 120 | .. | .. |
| Ipswich | „ 16 | 1,076 | + 140 | 24 | 11,970 | + 829 | 10·5 | .. |
| Kilmarnock | „ 16 | 312 | — 1 | 18 | 3,169 | + 311 | 4·25 | .. |
| Lancashire United | „ 13 | 3,023 | + 50 | 37 | 50,374 | + 1,755 | 39 | .. |
| Leeds | „ 16 | 15,405 | +1,176 | 24 | 185,738 | +13,311 | 108 | .. |
| Leicester | .. | .. | .. | .. | .. | .. | .. | .. |
| †Leith | „ 16 | 664 | + 55 | 179 | 12,691 | + 1,098 | 8·7 | .. |
| Liverpool | „ 9 | 23,462 | + 558 | 36 | 411,478 | +11,506 | 116 | 2·5 |
| ‡L.C.C. | „ 6 | 86,511 | +4,600 | .. | 1,021,978 | +64,302 | 141·6 | 8·5 |
| London United | „ 16 | 14,183 | + 897 | .. | 248,532 | +10,844 | .. | .. |
| Lowestoft | .. | .. | .. | .. | .. | .. | 3·5 | .. |
| Manchester | „ 16 | 82,728 | +1,119 | 24 | 897,142 | +23,118 | 188 | .. |
| Newcastle | „ 16 | 8,268 | + 87 | .. | 104,289 | + 7,668 | 14·5 | .. |
| †Newport | „ 9 | 702 | + 23 | 23 | 17,138 | + 913 | 14·5 | .. |
| Oldham | „ 17 | 3,904 | + 286 | 25 | 49,165 | + 1,974 | 23·78 | ·5 |
| Portsmouth | .. | .. | .. | .. | .. | .. | 15·25 | .. |
| Preston | „ 13 | 1,677 | + 107 | 24 | 19,440 | + 1,490 | .. | .. |
| Salford | „ 11 | 2,850 | + 153 | 23 | 116,705 | + 6,177 | .. | .. |
| Sheffield | „ 19 | 12,676 | + 758 | .. | 161,492 | +10,889 | 40 | .. |
| Southampton | „ 13 | 2,857 | + 459 | 24 | 31,398 | + 4,178 | 12 | .. |
| Southend-on-Sea | „ 13 | 2,145 | + 530 | 24 | 19,743 | + 3,068 | .. | .. |
| South Shields | „ 16 | 1,263 | + 115 | 24 | 16,004 | + 1,938 | .. | .. |
| †Swindon | „ 6 | 184 | + 20 | 23 | 3,778 | + 483 | .. | .. |
| Tyneside | „ 13 | 1,021 | + 127 | 11 | 6,287 | + 802 | .. | .. |
| Wallasey | „ 16 | 2,377 | + 322 | 24 | 28,648 | + 4,471 | .. | .. |
| Walthamstow | „ 16 | 1,540 | + 94 | 24 | 19,896 | + 1,726 | 9 | .. |
| †West Ham | „ 17 | 2,814 | + 309 | 23 | 64,902 | + 6,491 | 15·25 | .. |
| Wolverhampton | „ 13 | 2 006 | + 160 | 24 | 24,845 | + 1,639 | 25 | .. |
| Cen. London Rly. | „ 16 | 8,688 | —2,122 | 11 | 47,818 | —10,287 | 6·32 | .. |
| City & S. Lon. Rly. | „ 17 | 6 260 | — 12 | 11 | 33,428 | — 468 | 7·26 | .. |
| Dublin-Lucan Rly. | „ 15 | 349 | + 11 | 11 | 1,927 | — 89 | 7 | .. |
| G.N. and City Rly. | „ 16 | 2,714 | — 3 | 11 | 14,824 | + 248 | 3·5 | .. |
| L'pool Overh'd Rly. | „ 17 | 3 267 | + 374 | .. | 17,047 | + 723 | 6·8 | 4·8 |
| Llandudno-Col. Bay | „ 15 | 1,282 | — 85 | 41½ | 18,181 | + 492 | .. | .. |
| London Elec. Ry. Co. | „ 16 | 28,290 | — 60 | 11 | 127,495 | + 1,415 | 21·25 | .. |
| Mersey Railway | „ 16 | 3,778 | — 158 | 11 | 19,788 | — 1,760 | 4·5 | .. |
| Metropolitan Rly. | „ 17 | 31,950 | —1,201 | 11 | 176,527 | + 4,451 | 24·5 | .. |
| Met. District Rly. | „ 16 | 21,045 | + 589 | 11 | 115,253 | + 4,817 | 24 | .. |
| Anglo-Argentine | „ 16 | 100,840 | +11,469 | .. | 1,608,398 | +170.278 | .. | .. |
| §Auckland | August | 15,968 | + 855 | 2 | 32,467 | +11,794 | 23·3 | ·6 |
| Bombay (B.E.T.) | Aug. 18 | 5,648 | + 490 | 88 | 17,967 | + 2,699 | .. | .. |
| §Brisbane | August | 24,650 | +2,700 | 8 | 168,520 | +18,725 | .. | .. |
| Brit. Columbia Rly. | .. | .. | .. | .. | .. | .. | .. | .. |
| Calcutta | Sept. 16 | 8,046 | + 670 | .. | .. | .. | .. | .. |
| Cape Electric T.Ld. | .. | .. | .. | .. | .. | .. | .. | .. |
| §Kalgoorlie, W.A. | August | 3,853 | .. | 8 | 27,637 | .. | 20·5 | .. |
| §Lisbon | .. | .. | .. | .. | .. | .. | .. | .. |
| Madras | Sept. 15 | 1,691 | + 150 | .. | 25,203 | + 2,180 | .. | .. |
| §Montevideo | August | 24,015 | +1,759 | .. | 360,273 | +14,653 | .. | .. |
| Perth (W.A.) | Sept. 15 | 5,159 | —1,068 | .. | 69,347 | +13,570 | 22 | .. |

* Compared with the corresponding period of 1910. † One week only.
‡ Includes horse, steam and other receipts. § One month.

# SHARE LIST OF ELECTRICAL COMPANIES.

## ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

| NAME. | Stock or Share. | Dividends for 1909. | Dividends for 1910. | Closing Quotations Sept. 19th. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| Bournemouth & Poole, Ord. | 10 | 5½ | 5½ | 7⅜ — 8¼ | .. | 6 5 9 |
| Do. 4½ % Pref. | 10 | 4½ | 4½ | 8¼ — 9¼ | .. | 4 12 4 |
| Do. Second 6 % Pref. | 10 | 6 | 6 | 10 — 10½ | .. | 5 14 3 |
| Do. 4½ % Deb. Stock | Stock | 4½ | 4½ | 101 —103 | .. | 4 7 5 |
| Brompton & Kensington, Ord. | 5 | 10 | 10 | 7⅜ — 8⅜ | .. | 6 3 1 |
| Do. 7 % Cum. Pref. | 5 | 7 | 7 | 7⅜ — 7⅝ | .. | 4 7 6 |
| Central Electric Supply, 4 % Guar. Deb. | 100 | 4 | 4 | 99 —102 | .. | 3 18 5 |
| Charing Cross, West End & City Do. 4½ % Cum. Pref. | 5 | 5 | 5 | 3¾ — 4¼ | .. | 5 19 2 |
| Do. "City Undertaking" 4½ % Cum. Pref. | 5 | 4½ | 4½ | 4⅛ — 5 | .. | 4 10 0 |
| Do. Do. 4 % Deb. | 100 | 4 | 4 | 94 — 98 | .. | 4 1 8 |
| Chelsea, Ord. | 5 | 4½ | 5 | 3¾ — 4⅜ xd | .. | 5 14 3 |
| Do. 4½ % Deb. | Stock | 4½ | 4½ | 98 —100 | .. | 4 10 0 |
| City of London, Ord. | 10 | 7 | 7 | 12 — 12½ | .. | 5 12 0 |
| Do. 6 % Cum. Pref. | 10 | 6 | 6 | 11¾ — 12¾ | .. | 4 14 1 |
| Do. 5 % Deb. | Stock | 5 | 5 | 119 —123 | .. | 4 1 4 |
| Do. 4½ % Second Deb. | 100 | 4½ | 4½ | 100 —103 | .. | 4 7 5 |
| County of Durham, 5 % First Mort. Deb. | Stock | 5 | 5 | 89½ — 91½ | .. | 5 9 3 |
| County of London, Ord. | 10 | 5 | 5 | 7⅜ — 7⅝ | .. | 6 7 0 |
| Do. 6 % Pref. | 10 | 6 | 6 | 10⅜ — 11¼ | .. | 5 6 8 |
| Do. 4½ % Deb. | Stock | 4½ | 4½ | 108 —110 | .. | 4 1 10 |
| Do. 4½ % Second Deb. | Stock | 4½ | 4½ | 100⅝—103½ | .. | 4 7 0 |
| Edmundson's, Ord. | 5 | Nil | Nil | ¼ — ⅜ | .. | Nil |
| Do. 6 % Cum. Pref. | 5 | Nil | Nil | 2 — 2½ | .. | Nil |
| Do. 4½ % First Mort. Deb. | 100 | 4½ | 4½ | 83 — 86 | .. | 5 4 8 |
| Folkestone | 5 | 5½ | 6 | 4¾ — 5 | .. | 6 0 0 |
| Do. 5 % Cum. Pref. | 5 | 5 | 5 | 4¾ — 5¼ | .. | 4 15 3 |
| Do. 4½ % First Deb. | 100 | 4½ | 4½ | 95 — 98 | .. | 4 11 10 |
| Hove | 5 | 8½ | 9 | 6⅞ — 7⅜ | .. | 6 2 0 |
| Kensington & Knightsbridge, Ord | 5 | 8 | 9 | 6⅞ — 7⅛ | .. | 6 0 0 |
| Do. 4 % Deb. | Stock | 4 | 4 | 91 — 93 | .. | 4 6 0 |
| Kent Elec. Power, 4½ % Deb. | Stock | 4½ | 4½ | 80 — 84 | .. | 5 7 2 |
| London Electric, Ord. | 3 | 2 | 2 | 1⅝ — 2 | .. | 3 0 0 |
| Do. 6 % Pref. | 5 | 6 | 6 | 4½ — 4⅝ | .. | 6 3 1 |
| Do. 4 % First Mort. Deb. | Stock | 4 | 4 | 89 — 92 | .. | 4 7 0 |
| Metropolitan | 5 | 5 | 5 | 3¾ — 4¼ | .. | 5 17 8 |
| Do. 4½ % Cum. Pref. | 5 | 4½ | 4½ | 4⅛ — 4⅜ | .. | 4 14 9 |
| Do. 4½ % First Mort. Deb. | Stock | 4½ | 4½ | 100 —105 | .. | 4 5 9 |
| Do. 3½ % Mort. Deb. | Stock | 3½ | 3½ | 84½— 87½ | .. | 4 0 0 |
| Midland Electric Corporation 4½ % First Mort. Deb. | 100 | 4½ | 4½ | 96½— 98½ | .. | 4 11 5 |
| Newcastle-on-Tyne | 5 | 4 | 4 | 3½ — 4 | .. | 5 0 0 |
| Do. 5 % Pref., Non. Cum. | 5 | 5 | 5 | 4 — 4½ | .. | 5 11 1 |
| North Metropolitan Power Supply, 5 % Mortgages (Red.) | 100 | 5 | 5 | 101 — 104 | .. | 4 16 2 |
| Notting Hill | 10 | 7½ | 8 | .. | .. | .. |
| Oxford | 5 | 7 | 7½ | 6 — 6½ xd | .. | 5 11 6 |
| St. James' and Pall Mall, Ord. | 5 | 10 | 10 | 8¾ — 9¼ | .. | 5 8 1 |
| Do. 7 % Pref. | 5 | 7 | 7 | 6⅝ — 7¼ | .. | 4 16 7 |
| Do. 3½ % Deb. | 100 | 3½ | 3½ | 85 — 87 | .. | 4 0 6 |
| Smithfield Markets, Ord. | 5 | Nil | Nil | 1⅜ — 1⅞ | .. | Nil |
| South London, Ord. | 4 | 5 | 5 | 2⅜ — 3 | .. | 6 13 4 |
| Do. 5 % First Mort. Deb. | 100 | 5 | 5 | 98½—101½ | .. | 4 18 6 |
| South Metropolitan, 7 % Pref. | 1 | 7 | 7 | 1⅛ — 1⅛ | .. | 5 17 11 |
| Do. 4½ % First Deb. Stock | 100 | 4½ | 4½ | 97 —100 | .. | 4 10 0 |
| Urban, Ord. | 5 | 5 | 5 | ¾ — 1 | .. | .. |
| Do. 5 % Cum. Pref. | 5 | 5 | 5 | 2 — 2½ | .. | .. |
| Do. 4½ % First Mort. Deb. | 100 | 4½ | 4½ | 87½ — 89½ | .. | 5 0 7 |
| Westminster, Ord. | 5 | 10 | 10 | 7⅞ — 8 | .. | 6 5 0 |
| Do. 4½ % Cum. Pref. | 5 | 4½ | 4½ | 4⅞ — 5⅛ | .. | 4 7 10 |

## COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

| | | | | | | |
|---|---|---|---|---|---|---|
| Adelaide, 6 % Pref. | 5 | 6 | 6 | 5¼ — 5⅝ | .. | 5 6 8 |
| Calcutta, Ord. | 5 | 8 | 8½ | 6⅜ — 7⅛ | .. | 5 19 4 |
| Do. 5 % Pref. | 5 | 5 | 5 | 4¼ — 5¼ | .. | 4 15 3 |
| Calgary Power, 1st Mort. Bds. | 100 | 5 | 5 | 96 — 98 | .. | 5 2 0 |
| Canadian Gen. El. Com. | $100 | 7 | 7 | 105 —110 | .. | 6 7 3 |
| Do. 7 % Pref. | $100 | 7 | 7 | 121 —125 | .. | 5 12 0 |
| Cordoba Lt., Power and T., Ord. | 1 | 2 | 3 | ¾ — ⅞ | .. | 3 8 4 |
| Do. 5 % Deb. | 100 | 5 | 5 | 94 — 97 | .. | 5 3 1 |
| Elec. Lt. and P. of Cochabamba, 6 % Bonds | 100 | .. | 6 | 94 — 96 | .. | 6 5 0 |
| Elec. Supply Victoria, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 84½— 87½ | .. | 5 14 3 |
| Elec. Dev. Ontario, 5 % 1st Mort. Bonds | $500 | 5 | 5 | 85 — 87 | .. | 5 14 11 |
| Kalgoorlie Elec. P. and L., Ord. | 10/- | Nil | Nil | 1/32 — 3/32 | .. | Nil |
| Do. 6 % Pref. | 1 | 6 | 6 | 13/32 — 15/32 | .. | 8 6 8 |
| Kaministiquia Power, 5 % G. Bs. | $500 | 5 | 5 | 101½—103½ | .. | 4 16 7 |
| Madras, Ord. | 5 | Nil | .. | 2⅜ — 3⅛ | .. | .. |
| Melbourne, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 95 — 97 | .. | 5 3 1 |
| Mexican El. Lt., 5 % 1st M. Bds. | .. | 5 | 5 | 86½ — 88½ | —1 | 5 13 0 |
| Mexican Lt. & Power, Common | $100 | 4 | 4 | 85 — 87 | —1 | 4 12 0 |
| Do. 7 % Cum. Pref. | $100 | 7 | 7 | 106 —108 | — ½ | 6 9 8 |
| Do. 5 % 1st Mort. Gold Bds. | .. | 5 | 5 | 93 — 95 | —1 | 5 5 3 |
| Monterey Rly. Light & Power, 5 % 1st Mort. Deb. | 100 | 5 | 5 | 88 — 90 | .. | 5 11 1 |
| Montreal, Lt., H. and Power | $100 | 6 | 7 | 165 —170 | .. | 4 2 4 |
| Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds | $500 | 5 | 5 | 39 — 41 | .. | 12 3 10 |
| River Plate, Ord. | Stock | 9 | 10 | 218 —228 | .. | 4 7 9 |
| Do. 6 % Non-Cum. Pref. | Do. | 6 | 6 | 107 —114 | .. | 5 5 3 |
| Do. 5 % Deb. Stock | Do. | 5 | 5 | 101½—103½ | .. | 4 16 7 |
| Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb. | 100 | 4½ | 4½ | 100 —102 | .. | 4 8 3 |
| Shawinigan Water, Capital | $100 | 4 | 4 | 114 —116 | .. | 3 0 9 |
| Do. 5 % Con. 1st Mort. Bonds | $500 | 5 | 5 | 107 —109 | .. | 4 11 9 |
| Do. 4½ % Per. Deb. | Stock | 4½ | 4½ | 103 —105 | .. | 4 5 9 |
| Toronto Power, 4½ % Deb. | Do. | 4½ | 4½ | 100 —102 | .. | 4 8 3 |
| Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb. | 100 | 5 | 5 | 92 — 94 | .. | 5 6 5 |
| Victoria Falls Power, Pref. | 1 | Nil | Nil | 1/16 — 1 | .. | .. |
| West Kootenay Power and Lt., 1st Mort. 6 % Gold | 100 | .. | 6 | 105 —107 | .. | 5 12 2 |

## TELEGRAPH AND TELEPHONE COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Amazon Telegraph | 10 | Nil | Nil | 7⅞ — 7¾ | .. | Nil. |
| Do. 5 % Deb. Red. | Stock | 5 | 5 | 98¼—100½ | .. | 4 19 6 |
| American Telep. & Teleg., Cap. | $100 | 8 | 8 | 138 —140 | +1 | 5 14 4 |
| Do. Collat. Trust | $1000 | 4 | 4 | 94 — 96 | .. | 4 3 4 |
| Anglo-American Telegraph | Stock | 3⅝ | 3½ | 67 — 69 | — ⅛ | 5 8 8 |
| Do. 6 % Pref. | Do. | 6 | 6 | 112 —113 | + ⅛ | 5 6 2 |
| Do. Def. | Do. | 25/- | 30/- | 24⅞ — 25⅛ | + ⅛ | 5 19 5 |
| Anglo-Portuguese Tel., 5 % Mort. Deb. | 100 | 5 | 5 | 101 —103 | .. | 4 17 1 |
| Chili Telephone | 5 | 8 | 7 | 6¹⁵/₁₆— 7⅛ | .. | 4 18 3 |
| Commercial Cable, Stlg. 4% Deb. | Stock | 4 | 4 | 87½ — 89½ | .. | 4 9 5 |
| Cuba Telegraph | 10 | 6 | 6 | 10⅜ — 11 | .. | 5 9 1 |
| Do. 10 % Pref. | 10 | 10 | 10 | 17⅛ — 18½ | .. | 5 9 7 |
| Direct Spanish Telegraph, Ord. | 5 | 4 | 4 | 3¾ — 4 | .. | 5 0 0 |
| Do. 10 % Cum. Pref. | 5 | 10 | 10 | 8⅜ — 8¾ | .. | 5 14 3 |
| Do. 4½ % Debs. | 50 | 4½ | 4½ | 100 —102 | .. | 4 8 3 |
| Direct United States Cable | 10 | 4½ | 4½ | 7⅞ — 8⅛ | .. | 5 7 5 |
| Direct W. India Cable, 4½ % Reg. Deb. | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| Eastern Telegraph, Ord. Stock | Stock | 7 | 7 | 137 —140 | .. | 5 0 0 |
| Do. 3½ % Pref. Stock | Do. | 3½ | 3½ | 84 — 86 | .. | 4 1 5 |
| Do. 4 % Mort. Deb. | Do. | 4 | 4 | 102 —104 | .. | 3 16 11 |
| Eastern Extension | 10 | 7 | 7 | 13¾ — 14 | .. | 5 0 0 |
| Do. 4 % Deb. | Stock | 4 | 4 | 100½—102½ | .. | 3 18 1 |
| East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub. | 25 | 4 | 4 | 100 —102 | .. | 3 18 5 |
| Globe Telegraph and Trust | 10 | 5⅞ | 5⅞ | 10¾ — 11 | — ⅛ | 5 6 10 |
| Do. 6 % Pref. | 10 | 6 | 6 | 13 — 13½ | .. | 4 8 11 |
| Great Northern Telegraph | 10 | 18 | 18 | 30½ — 31½ | .. | 5 14 3 |
| Indo-European Telegraph | 25 | 13 | 13 | 56½ — 58½ | .. | 5 11 1 |
| Mackay Companies Common | $100 | 4 | 5 | 83 — 85 xd | .. | 5 17 8 |
| Do. 4 % Cum. Pref. | $100 | 4 | 4 | 74 — 76 xd | .. | 5 5 3 |
| Marconi's Wireless Telegraph | 1 | Nil | Nil | 2⅞₂ — 2¹¹/₃₂ | — 1/32 | .. |
| Monte Video Telephone, Ord. | 1 | 6 | 6 | ⅞ — 1 | .. | 6 0 0 |
| Do. 5 % Pref. | 1 | 5 | 5 | ¾ — ⅞ | .. | 5 10 4 |
| National Telephone, Pref. | Stock | 6 | 6 | 104 —106 | .. | 5 18 2 |
| Do. Def. | Do. | 6 | 6 | 114 —117 | —2 | 5 2 7 |
| Do. 6 % Cum. 1st Pref. | 10 | 6 | 6 | 9¾ — 10⅜ | — ⅛ | 5 12 11 |
| Do. 6 % Cum. 2nd Pref. | 10 | 6 | 6 | 9¾ — 10⅜ | — ⅛ | 5 12 11 |
| Do. 5 % Non-cum. 3rd Pref. | 5 | 5 | 5 | 5⅛ — 5⅜ | .. | 4 9 11 |
| Do. 3½ % Deb. | Stock | 3½ | 3½ | 98⅜—100⅜ | .. | 3 9 8 |
| Do. 4 % Deb. | Do | 4 | 4 | 99¾—100¾ | .. | 3 19 7 |
| New York Telep., 4½ % Gen. Bnds. | 100 | 4½ | 4½ | 102¼—103¼ | .. | 4 7 0 |
| Oriental Telep. and Elec. | 1 | 8 | 8 | 1⅛ — 1⅜ | .. | 4 18 6 |
| Do. 6 % Cum. Pref. | 1 | 6 | 6 | 1⅛ — 1⅛ | .. | 4 11 5 |
| Do. 4 % Red. Deb. | Stock | 4 | 4 | 88 — 90 | .. | 4 8 11 |
| Pacific and European Tel., 4 % Guar. Debs. | Do. | 4 | 4 | 99½—101½ | .. | 3 18 10 |
| Reuter's | 8 | 5 | 5 | 8⅞ — 9⅜ | + ⅛ | 4 5 0 |
| Submarine Cables Trust | Cert. | 6 | 6 | 133 —136 | +1 | 4 8 3 |
| Telephone Co. of Egypt, 4½ % Deb. Red. | Stock | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| United River Plate Telephone | 5 | 8 | 8 | 7⅞ — 7¹⁵/₁₆ | .. | 5 7 7 |
| Do. 5 % Cum. Pref. | 5 | 5 | 5 | 5⅛ — 5⅜ | .. | 4 10 11 |
| West Coast of America | 2½ | 2½ | 2½ | 1⅛ — 1⅜ | .. | 6 5 0 |
| Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel. | 100 | 4 | 4 | 98 —100 | .. | 4 0 0 |
| West India and Panama Teleg. | 10 | Nil | ¾ | 2⅜ — 2¹³/₁₆ | + 1/16 | 2 13 4 |
| Do. 6 % Cum. 1st Pref. | 10 | 6 | 6 | 10¾ — 10⅞ | .. | 5 12 11 |
| Do. 6 % Cum. 2nd Pref. | 10 | 14½ | 6 | 9½ — 10¼ | .. | 5 17 1 |
| Do. 5 % Debs. | 100 | 5 | 5 | 101 —103 | .. | 4 17 1 |
| Western Telegraph, Ltd. | 10 | 7 | 7 | 13¾ — 13⅞ | — ⅛ | 5 1 10 |
| Do. 4 % Deb. | Stock | 4 | 4 | 101 —103 | .. | 3 17 8 |
| Western Union Tel., 4% Bnds. A | $1000 | 4 | 4 | 107 —110 | .. | 3 12 9 |
| Do. 4½ % Fdg. Bonds | $1000 | 4½ | 4½ | 101 —104 | .. | 4 6 7 |

* Unless otherwise stated, all shares are fully paid.

**Continued on next page.**

## SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

### ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

| NAME. | Stock or Share. | Dividends for 1909. | Dividends for 1910. | Closing Quotations Sept. 19th. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| Bath Trams, Pref. Ord. | 1 | Nil | Nil | 1/32 — 1/16 | .. | Nil |
| Do. 5 % Pref. | 1 | 5 | 5 | 1/2 — 3/4 | .. | 6 13 4 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 79 — 83 | .. | 5 8 5 |
| Brit. Elec. Trac., Ord. | 10 | Nil | Nil | 3/32 — 1/16 | .. | Nil |
| Do. 6 % Pref. | 10 | 1½ | 1½ | 9 3/16 — 3 7/16 | .. | 3 17 5 |
| Do. 5 % Deb. | 100 | 5 | 5 | 93 — 96 | .. | 5 4 2 |
| Do. 4½ % 2nd Deb. | 100 | 4½ | 4½ | 74 — 78 | .. | 5 15 5 |
| Central London Railway, Ord. | 100 | 3 | 3 | 66 — 68 | .. | 4 8 3 |
| Do. Pref. | 100 | 4 | 4 | 85 — 87 | .. | 4 12 0 |
| Do. Def. | 100 | 2 | 2 | 49 — 51 | .. | 3 18 5 |
| Do. 4 % Deb. | 100 | 4 | 4 | 102 —104 | .. | 3 16 11 |
| City & South London, Ord. | 100 | 1½ | 1½ | 29 —30 | .. | 5 0 0 |
| Do. 5 % Pref., 1891 | 100 | 5 | 5 | 108 —110 | .. | 4 11 0 |
| Do. Do. 1896 | 100 | 5 | 5 | 104 —106 | .. | 4 14 4 |
| Do. Do. 1901 | 100 | 5 | 5 | 103 —105 | .. | 4 15 3 |
| Do. Do. 1903 | 100 | 5 | 5 | 102 —104 | .. | 4 16 2 |
| Do. 4 % Deb. | 100 | 4 | 4 | 102 —104 | .. | 3 16 7 |
| Dublin United Trams, 6 % Pref. | 10 | 6 | 6 | 11 — 12 | — 1/2 | 5 0 0 |
| Great Northern & City, Pr'f. Ord | 10 | Nil | Nil | 1/8 — 1/4 | .. | Nil |
| Hastings Trams, 6 % Pref. | 5 | Nil | Nil | .. | .. | Nil |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 75 — 80 | .. | 5 12 6 |
| Isle of Thanet Trams, 5 % Pref. | 5 | 1½ | 2½ | 2 5/8 — 3 | .. | 4 3 4 |
| Do. 4 % Deb. | 100 | 4 | 4 | 77 — 82 | .. | 4 17 7 |
| Lancashire United, 5 % Deb. | 100 | 5 | 5 | 79 — 82 | .. | 6 1 11 |
| London Elec. Railw'ys, 4 % Deb. | 100 | 4 | 4 | 96 — 98 | .. | 4 1 8 |
| London United Trams, 5 % Pref. | 10 | Nil | Nil | 3 — 3 1/4 | — 1/4 | Nil |
| Do. 4 % Deb. | 100 | 4 | 4 | 72 — 76 | .. | 5 5 8 |

| NAME. | Stock or Share. | Dividends for 1909. | Dividends for 1910. | Closing Quotations Sept. 19th. | Rise + or Fall — | Present Yield p.c. £ s. d. |
|---|---|---|---|---|---|---|
| Metropolitan Railway Consol. | 100 | 1 | 1 1/8 | 41 1/4 — 41 3/8 | —1/8 | 3 5 10 |
| Do. Surplus Lands | 100 | 2 1/8 | 2 1/8 | 64 — 66 | .. | 4 3 4 |
| Do. 3½ % Deb. | 100 | 3½ | 3½ | 90 — 92 | —2 | 3 16 1 |
| Do. 3½ % Pref. | 100 | 3½ | 3½ | 87 — 89 | —1 | 3 18 8 |
| Do. 3½ % Con. Pref. | 100 | 3½ | 3½ | 86 — 88 | —1 | 3 19 7 |
| Metropolitan District Ord. | 100 | Nil | Nil | 23 1/4 — 23 1/2 | — 1/4 | Nil |
| Do. 6 % Deb. | 100 | 6 | 6 | 145 —147 | .. | 4 1 8 |
| Do. 4 % Deb. | 100 | 4 | 4 | 96 — 98 | .. | 4 1 8 |
| Do. 4 % Prior Lien | 100 | 4 | 4 | 100 —102 | .. | 3 18 5 |
| Do. 4½ % First Pref. | 100 | Nil | 3½ | 85 — 87 | .. | 3 14 9 |
| Do. 3½ % Gtd. | 100 | 3½ | 3½ | 74 — 76 | .. | 4 9 9 |
| Metropolitan Elec. Trams, Ord. | 1 | 5 | 5 | 1 1/32 — 1 1/16 | .. | 5 6 8 |
| Do. Def. | 1 | Nil | Nil | 3/32 — 1/8 | .. | Nil |
| Do. 5 % Pref. | 1 | 5 | 5 | 1 — 1 1/32 | .. | 5 0 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 99 —101 | .. | 4 9 1 |
| Do. 5 % Deb. | 100 | 5 | 5 | 102 —104 | .. | 4 16 2 |
| Potteries, Ord. | 1 | 2 | 2 | 1/32 — 1/16 | .. | .. |
| Do. 5 % Pref. | 1 | 5 | 5 | 3/16 — 3/32 | .. | 7 12 4 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 88 — 91 | .. | 5 18 11 |
| South Metro. Trams, 6 % Pref. | 1 | 3 | 6 | 1/8 — 1/4 | .. | 10 3 0 |
| Do. 4 % Deb. | 100 | 4 | 4 | 73 — 78 | .. | 5 15 5 |
| Underground Elec. Railways | .. | .. | .. | .. | .. | .. |
| Do. 4½ % Bonds | 100 | 4½ | 4½ | 98 —100 | .. | 4 10 0 |
| Do. 6 % Income | 100 | Nil | 1 | 59 — 61 | .. | 1 12 9 |
| Do. Power House Debs. | 100 | .. | 4 | 101 —103 | .. | 3 17 8 |
| Yorkshire (West Riding), Ord. | 5 | Nil | Nil | 1/32 — 1/16 | .. | Nil |
| Do. 6 % Pref. | 5 | Nil | Nil | 2 3/16 — 2 5/16 | .. | Nil |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 80 — 85 | .. | 5 5 11 |

### ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

| | | | | | | |
|---|---|---|---|---|---|---|
| Anglo-Arg. Trams, 1st Pref. | 5 | 5 | 5 | 5 1/16 — 5 1/8 | .. | 5 3 6 |
| Do. 2nd Pref. | 5 | 5 | 5 | 4 1/2 — 5 | .. | 5 0 0 |
| Do. 4 % Deb. | 100 | 4 | 4 | 93 1/2 — 95 1/2 | — 1/2 | 4 3 9 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 101 —103 | .. | 4 7 5 |
| Do. 5 % Deb. | 100 | 5 | 5 | 101 —103 | .. | 4 17 1 |
| Auckland Trams, 5 % Deb. | 100 | 5 | 5 | 102 —105 | .. | 4 16 2 |
| Bombay Elec. S. & Trams, Pref. | 10 | 6 | 6 | 10 3/8 — 11 1/4 | .. | 5 6 8 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 96 1/2 — 98 1/2 | .. | 4 11 5 |
| Do. 5 % 2nd Deb. | 100 | 5 | 5 | 97 — 99 | .. | 5 1 0 |
| Brisbane Trams Invt., Ord. | 5 | 8 | 8 | 6 3/8 — 7 1/8 | .. | 5 12 3 |
| Do. 5 % Pref. | 5 | 5 | 5 | 5 — 5 3/8 | .. | 4 13 0 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 102 —105 | .. | 4 5 9 |
| B. Columbia Elec. Rly., Def. | 100 | 8 | 8 | 138 —142 | +1 | 5 12 8 |
| Do. Pref. Ord. | 100 | 6 | 6 | 119 —123 | .. | 4 17 7 |
| Do. 5 % Pref. | 100 | 5 | 5 | 106 —109 | .. | 4 11 9 |
| Do. 4½ % 1st Mort. Deb. | 40 | 4½ | 4½ | 100 —103 | .. | 4 7 5 |
| Do. 4½ % Vancouver Deb. | 100 | 4½ | 4½ | 101 —104 | .. | 4 6 7 |
| Do. 4½ % Con. Deb. | 100 | 4½ | 4½ | 101½ —103½ xd | .. | 4 5 4 |
| Calcutta Trams, Ord. | 5 | 4½ | 6 | 5 3/8 — 6 1/4 | .. | 4 16 0 |
| Do. 5 % Pref. | 5 | 5 | 5 | 5 — 5 1/4 | .. | 4 15 3 |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 102 —105 | .. | 4 5 9 |
| Cape Electric Trams | 1 | Nil | Nil | 7/16 — 1/2 | .. | Nil |
| City Buenos Aires Trams (1904) | 5 | 5 | 5 | 5 3/16 — 5 1/4 | .. | 4 12 6 |
| Do. 4 % Deb. | 100 | 5 | 5 | 95 — 98 | .. | 5 2 0 |
| Colombo Elec. Tr. & Lt., 5 % Deb. | 100 | 5 | 5 | 95 —100 | .. | 5 0 0 |
| Havana Elec. Rly., 5 % Bonds | $1000 | 5 | 5 | 100 —103 | .. | 4 17 1 |
| Kalgoorlie Elec. Trams | 1 | Nil | Nil | 7/16 — 1/2 | .. | Nil |
| Do. 5 % A Deb. | 100 | 5 | 5 | 92 1/4 — 95 1/2 | .. | 5 4 9 |
| Do. 6 % B Deb. | 100 | 6 | 5 | 63 — 67 | .. | 7 9 3 |

| | | | | | | |
|---|---|---|---|---|---|---|
| La Plata Elec. Trms, Prf. | 1 | 6 | 6 | 1 5/8 — 1 11/16 | .. | 5 13 0 |
| Lisbon Elec. Trams, Ord. | 1 | 5½ | 5½ | 1 — 1 1/8 | .. | 4 8 0 |
| Do. 6 % Pref. | 1 | 6 | 6 | 1 — 1 1/8 | .. | 4 16 0 |
| Do. 5 % Deb. | 100 | 5 | 5 | 97 —101 | .. | 4 19 0 |
| Madras Elec. Tr. (1904), Deb. | 100 | 5 | 5 | 95 — 98 | .. | 5 2 0 |
| Manaos Trams & Lt., 1st Deb. | 100 | .. | 5 | 89 — 92 | +1 | 5 8 8 |
| Manila Elec. R. and Ltg., Bonds | $1000 | 5 | 5 | 98 —100 | .. | 5 0 0 |
| Mexico Trams Com. | $100 | 7 | 7 | 115 —117 | —2 | 5 19 8 |
| Do. Gen. Con. 5 % Bonds | .. | 5 | 5 | 96 — 98 | .. | 5 2 0 |
| Do. 6 % Bonds | 100 | 6 | 6 | 97 1/2 — 99 1/2 | —1/2 | 6 0 11 |
| Para Elec. Rlys. & Lt., Ord. | 5 | .. | 10 | 6 3/4 — 7 1/8 | — 1/8 | 7 0 4 |
| Do. 6 % Pref. | 5 | 6 | 6 | 5 1/2 — 5 3/4 | + 1/8 | 5 4 4 |
| Do. 5 % 1st Deb. | 100 | 5 | 5 | 99 1/2 —101 1/2 | .. | 4 18 6 |
| Perth (W.A.) Elec. Tr., Ord. | 1 | 2½ | 2½ | 1 1/8 — 1 3/16 | .. | 2 7 1 |
| Do. 5 % 1st. Deb. | 100 | 5 | 5 | 101 1/2 —103 1/2 | .. | 4 16 7 |
| Rangoon El. Tr. & Sup., Pref. | 5 | 6 | 6 | 5 3/8 — 5 5/8 | .. | 5 6 8 |
| Do. 4½ % 1st Deb. | 100 | 4½ | 4½ | 98 —101 | .. | 4 9 1 |
| Rio de Janeiro Trams | $100 | 1 | 4½ | 114 1/2 —115 1/2 | — 3/4 | 3 17 11 |
| Do. 1st Mort. 5 % Bonds | .. | 5 | 5 | 101 1/2 —102 1/2 | .. | 4 17 10 |
| Do. 5 % Mort. Bonds | 100 | 5 | 5 | 97 1/2 — 98 1/2 | .. | 5 1 6 |
| Sao Paulo Tram, Lt. and P. | $100 | 10 | 10 | 173 —176 xd | +1 1/2 | 5 13 8 |
| Do. 5 % 1st Deb. | $500 | 5 | 5 | 102 1/2 —104 1/2 | .. | 4 15 8 |
| Singapore Trams, 5 % Deb. | 100 | 5 | 5 | 83 — 87 | .. | 5 15 0 |
| Southern El. Tr. B.A., 5 % Deb. | 100 | 5 | 5 | 9 3/4 — 97 1/2 | .. | 5 2 7 |
| Un. Elec. Trams Monte Video | 5 | 5 | 6 | 5 1/4 — 6 | .. | 5 0 0 |
| Do. 6 % Pref. | 5 | 6 | 6 | 5 — 5 1/2 | .. | 5 9 1 |
| Do. 5 % 1st Deb. | 100 | 5 | 5 | 102 —105 | .. | 4 15 8 |
| Winnipeg Elec. Rly., 4½ % Deb. | 100 | 4½ | 4½ | 105 —107 xd | .. | 4 4 1 |

### MANUFACTURING COMPANIES.

| | | | | | | |
|---|---|---|---|---|---|---|
| Aron, Ord. | 1 | .. | Nil | 1/2 — 23/32 | .. | Nil |
| Do. 6 % Pref. | 1 | 12 | 9 | 1 1/16 — 1 3/16 | .. | 7 7 8 |
| Babcock & Wilcox | 1 | 24 | 26 | 5 3/4 — 5 7/8 | .. | 4 12 6 |
| Do. Pref. | 1 | 6 | 6 | 1 1/4 — 1 5/16 | .. | 4 0 0 |
| B.I. & Helsby Cables | 5 | 10 | 10 | 6 3/4 — 7 1/4 xd | .. | 6 17 11 |
| Do. Pref. | 5 | 6 | 6 | 5 1/4 — 6 1/4 | .. | 4 16 0 |
| Do. Deb. | 100 | 4½ | 4½ | 102 —104 | .. | 4 6 7 |
| British Thomson-Houston, Deb. | 100 | 4½ | 4½ | 94 — 97 | .. | 4 12 9 |
| British Westinghouse, Pref. | 3 | Nil | Nil | 1/8 — 3/8 | .. | Nil |
| Do. Deb. | 100 | 4 | 4 | 59 — 62 | .. | 6 9 1 |
| Do. 6 % Prior Lien | 100 | 6 | 6 | 102 —104 | .. | 5 15 5 |
| Browett, Lindley, Ord. | 1 | Nil | Nil | 1/6—2/- | .. | Nil |
| Do. Pref. | 1 | Nil | Nil | 5/- —6/- | .. | Nil |
| Brush, Ord. | 2 | Nil | Nil | 1/4 — 3/8 | .. | Nil |
| Do. 7 % Pref. | 2 | Nil | Nil | 1/4 — 3/8 | .. | Nil |
| Do. 4½ % Deb. | 100 | 4½ | 4½ | 56 — 61 | .. | 7 7 7 |
| Do. 4½ % Second Deb. | 100 | 4½ | 4½ | 39 — 44 | .. | 10 4 6 |
| Callender's Cable | 5 | 15 | 15 | 9 — 9 1/4 | .. | 7 17 11 |
| Do. Pref. | 5 | 5 | 5 | 4 1/8 — 5 3/16 | .. | 4 16 5 |
| Do. Deb. | 100 | 4½ | 4½ | 101 —103 | .. | 4 7 5 |
| Castner-Kellner | 1 | 14 | 17½ | 3 5/8 — 3 11/16 | + 1/16 | 4 14 11 |
| Do. Deb. | 100 | 4½ | 4½ | 103 —107 | .. | 4 4 1 |
| Crompton & Co. | 3 | Nil | Nil | 1/4 — 3/8 | .. | Nil |
| Do. Deb. | 100 | 5 | 5 | 57 1/2 — 67 1/2 | .. | 7 8 2 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Dick, Kerr | 1 | 6 | 5 | 1 3/8 — 1 1/2 | .. | 5 6 8 |
| Do. Pref. | 1 | 6 | 6 | 1 3/4 — 1 13/16 | .. | 5 9 7 |
| Do. Deb. | 100 | 4½ | 4½ | 96 — 98 | .. | 4 11 10 |
| Edison & Swan, A, £3 paid | 5 | Nil | Nil | 1/2 — 1 1/4 | .. | Nil |
| Do. fully paid | 5 | Nil | Nil | 1 1/2 — 2 1/4 | — 1/8 | Nil |
| Do. 4 % Deb. | 100 | 4 | 4 | 67 — 71 | .. | 5 12 8 |
| Do. 5 % Second Deb. | 100 | 5 | 5 | 78 — 81 | .. | 6 3 5 |
| Electric Construction | 2 | Nil | 2½ | 1/4 — 3/8 | — 1/8 | 6 13 4 |
| Do. Pref. | 2 | 7 | 7 | 1 1/4 — 1 1/2 | .. | 7 4 4 |
| Greenwood & Batley, Pref. | 10 | 7 | 7 | 7 1/2 — 8 1/2 | .. | 8 5 8 |
| Do. Deb. | 100 | 5 | 5 | 94 — 96 | .. | 5 4 2 |
| General Electric, Pref. | 10 | 5 | 5 | 8 1/2 — 9 | .. | 5 11 1 |
| Do. Deb. | 100 | 4 | 4 | 88 — 93 | .. | 4 6 0 |
| Henley's, Ord. | 5 | 15 | 15 | 12 — 12 1/2 | .. | 5 17 8 |
| Do. Pref. | 5 | 4½ | 4½ | 4 1/2 — 5 1/8 | .. | 4 5 11 |
| Do. Deb. | 100 | 4½ | 4½ | 106 1/2 —108 1/2 | .. | 4 2 11 |
| India-Rubber, G. & T. | 10 | 10 | 10 | 13 — 15 1/2 | + 1/2 | 6 9 0 |
| Do. Pref. | 10 | 5 | 5 | 9 1/2 — 10 1/2 | .. | 4 16 5 |
| Telegraph Construction | 12 | 17½ | 20 | 34 1/2 — 36 1/2 | .. | 6 11 7 |
| Do. Deb. | 100 | 4 | 4 | 100 —102 | .. | 3 18 5 |
| Willans & Robinson | 1 | Nil | Nil | 1/32 — 1/16 | .. | Nil |
| Do. Pref. | 5 | 1½ | Nil | 3/4 — 1 | .. | Nil |
| Do. Deb. | 100 | 4 | 4 | 55 — 65 | .. | 6 3 1 |

* Unless otherwise stated, all shares are fully paid.

Bank rate of Discount 3 per cent., March 9th, 1911.

## THE BRITISH ASSOCIATION.—III.

### Electric Drives for Screw Propellers.

By H. A. Mavor.

*Section G. (Abstract.)*

It may be said in general terms that high efficiency is associated with low rate of revolution of the propeller, while in the steam turbine high rates of revolution are essential to the most economical use of the steam. Internal-combustion engines have speeds more nearly approximating those of reciprocating steam engines, but here also there is a tendency to speeds higher than are convenient or economical from the propeller standpoint.

In addition to those fundamental incompatibilities arising from causes out of the reach of direct accommodation, there are other conditions which limit the direct application of engine to propeller.

At the present moment the economy of power production in the best practice on land is considerably in advance of what has been done at sea. The principal reason for the better economy of the land work is the higher rate of revolution of the power generator when untrammelled by propeller conditions.

Various methods of making the required adaptation of generator to propeller are at present under trial. For this, mechanical gearing by toothed wheels or hydraulic transmission may be considered serious competitors with electric transmission, but for large powers it seems reasonable to expect that electric transmission, which is already developed for this very purpose on land, is likely to find an equally useful field where the conditions are such as to require an intermediate device at sea. The cost, weight and efficiency of electric transmission compare favourably in the examples which have been examined with either of the two competing methods.

There are other important qualifications of electric transmission in which it stands altogether unrivalled. The most important of these qualifications are :—

It provides a ready means of reversing the direction of rotation of the propeller without changing the direction of rotation of the power generator.

The electric transmission also provides means for changing the speed ratio between generator and propeller, so as to permit of the power of the generator being developed under the most favourable conditions at all speeds of the ship.

Lastly, it provides means for applying the power of one or more engines to one or more propellers, so that the power generating units may be so disposed as to give the highest efficiency, and when they are not required they can be stopped. These properties of the electric transmission supply exactly what is required to render steam turbines, and also internal-combustion engines, completely adaptable to the purpose required.

Power generators give their best efficiency when full speed of rotation is maintained, even when running below full power. It is, therefore, advantageous to keep the engine revolutions within the range of governor control while the required speed change is accomplished by electric combinations.

The properties of the electric motor lend themselves well to the requirements of manœuvring. The rate of reversal is under perfect control. The possibilities of rapid and certain action are more than are attainable in a reciprocating steam engine connected direct to the propeller, and the electric motor is applicable to powers for which there is no possibility of using anything in the nature of reversing gears or clutches.

The property of combining the power of more than one engine for application to one or more propellers is the special feature of the author's inventions as distinguished from the ordinary methods of electrical engineering. Engines of different types, sizes and rates of revolution can have their powers combined without interconnection of their electric circuits, and without risk of mistake or error. An oil engine at 100 R.P.M. may be running the vessel at low speed, and a steam turbine running at 20 times the speed may be jointly applied to the propellers without any complication of the electric equipment. Each unit does its own work independently.

The advantage of such an equipment in vessels which are required to operate under varying load conditions is evident. Without subdivision of the power units, the whole of the main machinery must be in motion while the ship is in motion.

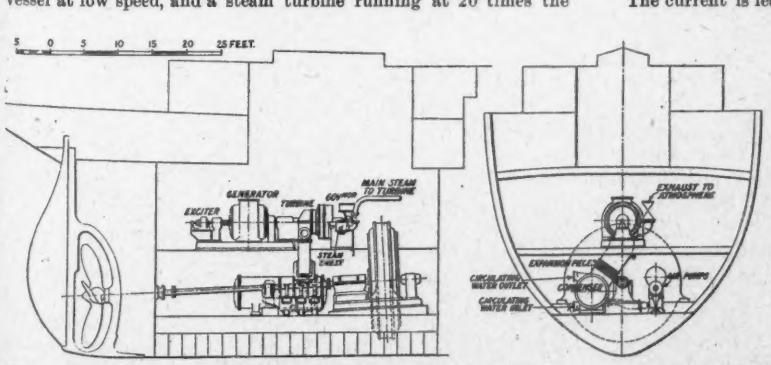


Fig. 1.—General Arrangement of Proposed 1,500-kw. A.C. Turbo-Electric Machinery for Bulk Freight, ss. "Frieda."

At speeds reduced below its normal rate of revolution, the turbine is even less economical than the steam engine. Sub-division into high-pressure, low-pressure and intermediate elements has been carried out in certain steam equipments, but this results in a somewhat complicated and inconvenient system of piping, because the steam has to be led from one part of the system to the other across the vessel. In the electric system each unit can be self-contained, and disposed in the manner best suited to a convenient arrangement of the engine room. The sizes of the individual units can be adjusted to suit the powers required at the different working speeds, or they may be duplicate and interchangeable.

A few examples of application of the system are here presented, together with a description of a small vessel built to demonstrate and illustrate the principles of operation and to provide experience in the use of the plant. In all cases alternating three-phase currents are used and interlocking devices connect mechanically the main reversing switches with the exciting switches so that no change can take place in the connections while they are passing currents.

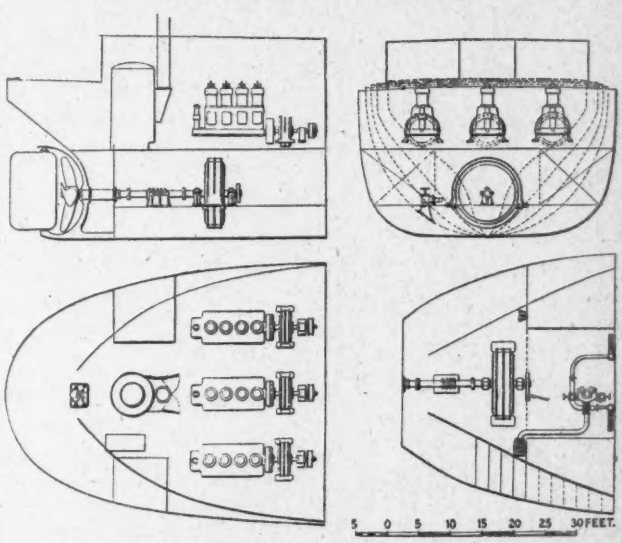


Fig. 2.—Proposed Arrangement of Oil-Electric Propulsion for Lake Steamer, 250 ft. by 42 ft. 6 in. by 19 ft.

The turbo-electric steamship *Frieda* has been specially designed for the transport of bulk freights between the Gulf of Mexico and New York City. The vessel is to be 300 ft. long and will carry a dead weight of, approximately, 5,000 tons at a mean loaded speed of 12 knots at sea.

The propelling machinery (fig. 1) is aft, and consists of a turbo-electric outfit for three-phase 50 cycles when running at 3,000 revs. per min. The turbine is supplied with steam at a pressure of 200 lb. per square inch at the stop valve.

This electric generating plant is arranged on foundations on a platform deck in the engine room, and the condensing plant in the engine-room hold. The condenser is fitted with a vacuum augmentor, and is suitable for dealing with the full load quantity of steam from the turbine. The vacuum obtained will be 28½ in., with cooling water about 85° F. The condensing plant consists of a vacuum condenser, three-throw air-pumps and centrifugal pumps with electric motor drives.

The current is led to a three-phase motor, which is keyed direct to the main propeller shaft, and is capable of developing 1,900 B.H.P. at a speed of about 84 R.P.M. The steam is generated in two Scotch boilers, with Howden's forced draught and liquid fuel burners.

This installation costs and weighs less than the normal equipment. The coal saving is over 10 tons per day.

The illustrations in fig. 2 show the application of the system to the propulsion of a 245-ft. Canadian canal type tank barge.

The equipment consists of three separate units of Diesel non-reversible oil engines, each capable of developing 200 shaft H.P., and directly connected to an alternating-current generator. The currents from one or all of the units are respectively led to the separate windings of a three-phase motor keyed to the main propelling shaft and operating a single slow-turning screw.

The great advantage and economy of this system consists in being able to run at full power or at one-third power, using one or three engines at full-load economy, at will, thus providing for an economical operation impossible with any other propulsive system. The fact that non-reversible oil engines are used, running under governor control, greatly simplifies the maintenance and operation.

The control is operated by a low-tension interlocking switch, operated by an ordinary engine-room telegraph stand located in the

pilot house, so that the manœuvring of the vessel is at all times in the hands of the navigating officer. This equipment increases the cost of the ship about 10 per cent. above the normal, but the carrying capacity is very largely increased.

The installation illustrated in fig. 3 shows a marine turbo-electric installation submitted to the U.S. Navy Department for adoption in one of the four large colliers recently given out to contract.

It consists of a steam turbo-alternator of 5,000-KW. capacity with condensing plant; the current is led to two motors, one being keyed

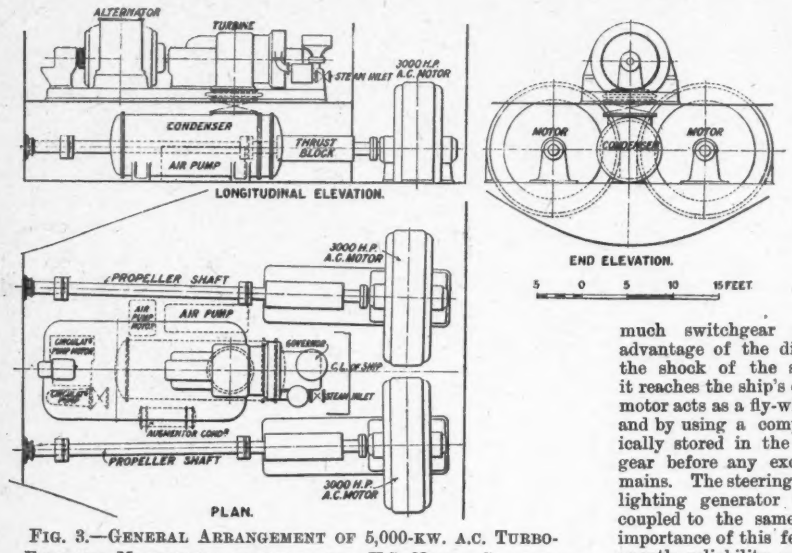


FIG. 3.—GENERAL ARRANGEMENT OF 5,000-KW. A.C. TURBO-ELECTRIC MACHINERY, PROPOSED FOR U.S. NAVAL COLLIERS.

to each propeller shaft. The machinery is right aft in the vessel; the steam is generated by Scotch boilers.

The vessels in which it is proposed to install this machinery are 525 ft. long, and will carry a dead weight of 12,500 tons of coal, at a speed of 14 knots at sea. Here again the cost, weight and economy are better than can be shown with the normal reciprocating-engine equipment.

## Electrical Steering.

By B. P. HAIGH, B.Sc., Assoc.M.Inst.C.E., Jas. Watt Engineering Laboratories, University of Glasgow.

*Section G. (Abstract.)*

ELECTRICAL power may be applied in steering in connection with two separate problems. In the first place, electrical apparatus may be used in place of the customary control shafting or hydraulic telemotor to transmit the motion of the hand wheel aft to the steering engine. Several such electrical "telemotors" are now available, and these have the advantages of being very easily worked even in the longest ships, and of convenience in installation. The second problem is that of supplying and controlling electrical power for moving the rudder itself, and it is here that electrical steering offers the greater advantage over gears now in general use requiring a supply of steam. The main difficulties experienced in electrical steering have been those of limiting the amount of power required to the capacity of the ship's dynamos, and of controlling the heavy power in a reliable manner. The electric motor must not only be arranged to move the rudder promptly and accurately within the small angles of 5° or less that are required for keeping a course, but must also be capable, without any adjustment of the control gear, of rapidly putting the helm hard over 35° to either side, against heavy water resistance.

In order to economise power, the gearing between the electric motor and rudder post should be designed for a high efficiency, and consequently it will not be "self-sustaining." Means must therefore be provided to hold the rudder in its hard-over position. A magnetic brake similar to those used on cranes is suitable for this purpose, and will also serve to stop the gearing promptly when the required position has been reached.

Experience has led to the design of steam engines of special proportions for steering, and in the same way electrical motors need not be designed to carry their full load continuously. Motors of smaller dimensions for "half-hour rating" and fitted with commutating poles are preferable, and as the heating limit is not here in question the motor may be totally enclosed even in large sizes, without any considerable increase in its dimensions.

Besides possessing adequate power, a steering gear must be satisfactory as regards sensitiveness—that is, it must be capable of moving the rudder to an angle that accurately corresponds to the position of the steering wheel. This is especially necessary within the range of small angles that are used for keeping the vessel on its course. In the highest class work the steering gear should respond to a motion of the hand wheel corresponding to one degree of helm (less than one-eighth turn of the wheel). A certain small amount of idle travel is desirable to prevent the gear being used too frequently. Sensitiveness does not only depend on the idle travel of the wheel but also on the "time lag"—*i.e.*, the interval between the movement of the wheel and the corresponding movement of the rudder. In this respect it appears that electrical steering may possess considerable advantage over ordinary steam gears, for as it can be arranged that the rudder responds more quickly, a closer course may be kept with watchful steering. As regards idle travel, there is little to choose between steam and electric gears.

In the following table a number of different types of electrical steering gear are classified according to the method of control:—

A. Steering gears in which the motor is started and stopped for every motion of the rudder:—(1) The motor being supplied with current at variable voltage from a special generator; (2) the motor being controlled by reversing switch and resistances.

B. Steering gears in which the motor is kept running continuously; mechanical control being introduced in one of the following forms:—(1) Friction clutches with gearing; (2) hydraulic transmission with rotary or reciprocating pumps; (3) magnetic friction clutches on motor shaft.

The second line of development, including the gears grouped together under heading B, appears to offer more promising results than method A, to which one great objection is the wear and tear unavoidable where so much switchgear for heavy currents is used. A further advantage of the different types classed together under B is that the shock of the sea on the rudder is greatly reduced before it reaches the ship's electrical installation. The armature of the motor acts as a fly-wheel, or extra fly-wheel weight may be added, and by using a compound motor a large part of the energy kinetically stored in the revolving masses is given up to the steering gear before any excessive current is demanded from the ship's mains. The steering gear can therefore be supplied from the ship's lighting generator without any noticeable flicker in the lamps coupled to the same mains. It is difficult to over-estimate the importance of this feature, both as regards simplicity, and consequently reliability, and as regards economy of power.

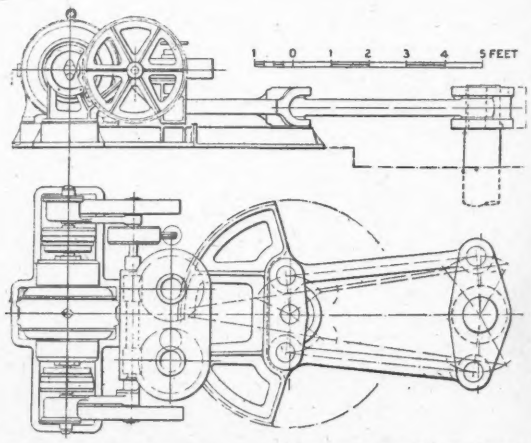


FIG. 1.—ARRANGEMENT OF ELECTRICAL STEERING GEAR FOR 11½-IN. RUDDER POST.

To indicate the amount of power required under these conditions we may take the case of the proposed gear described later, and shown in figs. 1 and 2; this is designed for an 11½-in. rudder post, suitable for a vessel, say, 450 ft. in length,, of 16 knots speed. In this case a motor of 30 B.H.P. is provided, capable of developing a torque of 175 ft.-tons in the rudder post and of moving the rudder through 70° in 20 seconds. These figures are based on special features in the design of the gear and on an efficiency of 64 per cent. in the gearing. The motor would be a D.C. machine, with compound winding, and would run at a speed of 500 R.P.M. under full load and at varying speeds up to 1,000 R.P.M. on lighter loads. The current required at full load would be 270 amperes at 100 volts. A vessel of this size, engaged in passenger service, would probably be provided with generating plant for lighting and forced-draught purposes, of about 200 KW., and if this is divided among four dynamos, each of 500 amperes capacity at 100 volts, it should be possible for any one of these running alone to put the helm hard over in emergency.

In the steering gear designed by the writer in conjunction with Messrs. Brown Bros. & Co., of Rosebank, Edinburgh, the control is by means of magnetic friction clutches, which have several advantages due to the absence of external thrust and the ease of the control. A number of tests have been made on an experimental gear of fair size. Figs. 1 and 2 show details of a proposed gear suitable for an 11½-in. rudder post, to which reference has already been made in connection with the amount of power provided. Although the motor in this gear runs continuously, no gearing is kept in motion, as the motor shaft is extended at either end to carry the two magnetic clutches, which are normally out of gear, leaving the rudder stationary. The driven portions of these clutches are carried on bearings and are geared to the countershaft carrying the worm

gear in such a way that the rudder is moved to port or starboard by bringing one or other of the clutches into action. The two parts of the clutch are drawn together by magnetic attraction, and a light spring is provided for withdrawing the clutch after the motion required is completed. The friction drive is transmitted by red fibre blocks bearing on the conical edge of the light steel disk that acts as the keeper of the magnet, and no thrust remains to be taken up by collars. Either ball bearings, as shown in fig. 2, or ring oiling journals may be used, provided the motor has not excessive end play. Provision is made for taking up wear on the fibre blocks by adjusting the inner ring on the clutch body to feed the blocks through holes in the outer ring. In the gear suitable for an 11½-in. rudder post, the clutch coils are fed with a current of ½ ampere, supplied through slip-rings enclosed within the motor. No electrical parts are therefore exposed to the action of damp, for as the motor is always running it keeps itself dry. Should it be desired to remove the armature, the clutches are removed at the same time, after sliding the fibre friction blocks back by turning both screwed rings on the clutch body. Impregnated fibre friction blocks have the advantage of engaging silently, whereas wood, although in some cases having a higher coefficient of friction, appears liable to squeak painfully. The mechanical arrangement of the gear shown in fig. 1 has certain novel features, notably the use of two pinions engaging with the toothed sector. As these carry equal loads, the wear is distributed, and a lighter sector may be used, with teeth of reduced pitch as compared with those necessary if only one pinion were provided. Further, a lower ratio of worm gear is required and a higher efficiency obtained. The loads on the two pinions are kept equal by using right and left-hand worm-gear, with an intermediate pinion to keep the directions of rotation right. The two worms are cut on a sleeve sliding freely on the shaft without thrust blocks, and as a certain amount of end play is provided between the bearings, the teeth of the sector can be allowed a considerable amount of wear without disturbing the equal distribution of the load. The quick pitch of the worms and the absence of frictional loss at thrust blocks ensure a very high efficiency being obtained.

The power required is further reduced by the use of variable leverage linkwork, in which the rudder crosshead and the dummy crosshead carrying the toothed sector are connected together at different radii, so that the connecting rods do not form a parallel motion. The leverage, which in the midships position is 1·5 to 1, increases gradually to 2·2 at the hard-over position of 35°, so that the maximum torque is obtained with less current when the rudder is hard-over; and, further, the gear responds more quickly in the ordinary working range amidships. As this linkwork is not a so-called "geometrical" motion, the positions of the crosshead pins must be carefully chosen; when this is properly done, no difficulty is found in working over to 38° of helm. In this way a saving of 30 per cent. can be made in the motive power, and taking account of the extra efficiency of the double worm-gear, the maximum torque of 175 ft.-tons is obtained with a current of 270 amperes at 100 volts, instead of 450 amperes as would be required with gearing of the ordinary type.

These features are incorporated in the experimental steering gear fitted with a hydraulic cylinder for applying the artificial load, which is so arranged that the tiller leverage is the same when the rudder is hard-over at 35° as when in the midships plane. It was found that the currents required to produce a pressure of 980 lb. per sq. in. on the 5-in. ram were 60 amperes when hard-over, and 90 amperes when amidships, corresponding to a change of leverage of 1·5 to 1. The time required to cross from hard-over to hard-over was 23 seconds when moving against the above load for 35° out of the total of 70°, the voltage of supply being 90 volts. At this load, which corresponds to a torque of 20·4 ft.-tons in the rudder post, the overall efficiency is 48 per cent., indicating an efficiency of over 60 per cent. in the gear alone without hydraulic cylinder or motor. Under normal conditions the slip of the clutches when engaging was found to be small, estimated by means of a contact-maker at between 1 and 2 revolutions, and up to the present, after a considerable period of testing in the works, no wear has had to be taken up on the fibre blocks. When the motor is loaded up to 150 amperes, corresponding to a torque of 50 ft.-tons, the clutches slip, and this current is not exceeded, even when the tiller is butted against a solid obstacle or when the chain is drawn taut from no load to full load.

The arrangements for controlling the clutches consist of one of Brown's improved hydraulic telemotors with a cut-off attachment coupled to the tiller crosshead. The switchgear, which is operated by mechanism equivalent to cam-gear, is enclosed in a small case (14 in. by 12 in. by 4 in.) mounted above the telemotor. In many vessels the telemotors are now attached to the deck beams overhead, and this arrangement is very suitable for electrical steering, as it keeps the switchgear free from water. Being fitted with carbon contacts, and dealing with such small currents, the switches should require but little attention. The cams require to be carefully arranged and free from backlash, to gain sensitive steering; and to stop the gear promptly a quick-acting brake, not necessarily very powerful, is used. The amount of stored energy is minimised by using light steel clutch disks and a motor with shunt regulation, running at its lowest speed when engaging and disengaging.

In installing electrical steering gear it is preferable to avoid the use of fuses or circuit breakers in the supply mains, as these are liable to operate just when the use of the helm is most urgently required, and any possible damage to the electrical plant is greatly outweighed by risk in navigation. When a gear with friction clutches is used a circuit breaker, adjusted for something over the limiting current of the clutches, may be fitted in the engine-room along with an auxiliary motor starter, so that the gear may be immediately restarted without leaving the main switchboard.

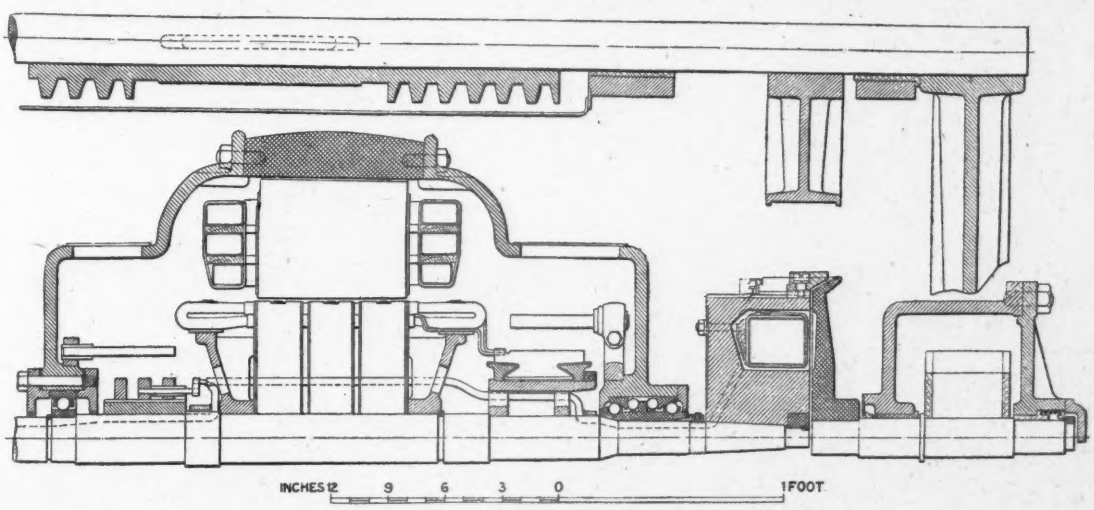


Fig. 2.—Section of Motor, Clutch and Gearing.

## Some Preliminary Notes on a Study as to Human Susceptibility to Vibration.

*Section G. (Abstract.)*

By W. Pollard Digby and Capt. H. Riall Sankey.

The authors point out that the variation of individual human sensitiveness has been investigated in regard to senses of taste, sight, sound and weight; and remark that the fact that different persons are affected in different manners by the same conditions of vibration calls for investigation. The phrase "human susceptibility to vibration" was coined to cover the range of sensitiveness of various people to vibrations of short duration of different amplitude and frequency, together with their opinions as to when these vibrations approached or exceeded the point of being a nuisance.

The authors have employed both verbal standards of degree of vibration and a precise unit of measurement. The former ranges from 1 to 8 degrees, imperceptible vibrations being classed as 1, and perceptible vibrations constituting an excessive nuisance at 8. The precise unit of measurement is that of a vibration having a maximum linear amplitude of one millimetre at a frequency of one cycle per second. From their investigations, so far confined to only a limited number of cases, the authors deduce that:—

1. The range of vibration classed as imperceptible is a wide one. Generally vibrations having an intensity of 0·10 to 0·20 units are imperceptible, but are in a lesser number of cases classed as faintly or very faintly perceptible.

2. In regard to very faintly perceptible vibrations, three cases class this as under 0·10 unit, six as between 0·10 and 0·20, six as between 0·40 and 0·50, while seven cases could only distinguish vibrations in excess of 0·50 unit.

3. All individuals show a fatigue effect and lose their sense of discrimination after 30 or 40 minutes. Generally the sensitiveness is diminished.

4. Individuals are divisible into two broad classes. Those capable of discrimination of vibrations of small intensity do not give con-

sistent opinions as to vibrations of large intensity. The opposite effect is observed in those capable of classifying vibrations of larger intensity.

5. That so far the general consensus of opinion points to conditions of perceptible vibration just attaining a nuisance being reached for a mean of intensity of 1 unit. Persons of delicate intensity rate this in the neighbourhood of 0·70 unit, and persons of coarse perceptiveness at about 2 units.

The authors suggest that it will be of interest to ascertain the effect of variations of conditions of physical health, age, sex and occupation in this respect.

They conclude by appealing for the co-operation of members of the British Association by their acting as subjects for experiment, and urge that from many points of view, not least the legal one, there should be some definition of what exact intensity of vibration constitutes a nuisance. Assistance in the further research contemplated by the authors will only involve spending about 45 minutes in Westminster, during which time the visitor's hand is placed on a table and the opinions are expressed of the vibration of the table, whether imperceptible, just perceptible or a nuisance.

## THE CENSUS OF PRODUCTION.

The preliminary tables under the Census of Production Act have now been concluded, and are published in an official report (Cd. 5,813) being Part IX of the series.

The present tables include, amongst other enterprises, gas undertakings, electricity undertakings, tramway and light railway companies, and the National Telephone Co., as well as the telegraph and telephone undertakings of the Post Office.

In his report to the Secretary of the Board of Trade, Sir G. R. Askwith says:—"The completion of the preliminary tables affords an opportunity of summarising the principal figures contained in this part and those already issued. This is done in the following table, which covers the returns relating to mines and quarries, iron and steel, and other metal trades, shipbuilding, engineering, the building, woodworking, and furnishing trades, the chemical and allied trades, the textile, clothing, and leather trades, food, drink, and tobacco manufacture, and public utility services with sundry minor industries, not clearly assignable to any of these principal groups." (Agriculture is excluded.)

Production in the Year 1907.

| — | Gross output. Selling value or value of work done. (1) | Materials used. Cost. (2) | Work given out. Amount paid to other firms. (3) | Net output. Excess of Col. (1) over Cols. (2) and (3). (4) | Average No. of persons employed (exluding outworkers). (5) |
|---|---|---|---|---|---|
| | Million £ | Million £ | Million £ | Million £ | |
| England & Wales | 1,483 | 860 | 20 | 603 | 5,764,000 |
| Scotland... ... | 208 | 116 | 5 | 87 | 885,000 |
| Ireland ... ... | 66 | 43 | 1 | 22 | 287,000 |
| United Kingdom | 1,757 | 1,019 | 26 | 712 | 6,936,000 |

In the Report of the Director of the Census accompanying the tables, it is stated that under Sec. 7 of the Census of Production Act, 1906, it is provided that "the exercise and performance by a local or other public authority of the powers and duties of that authority shall be treated as the trade or business of that authority." Public authorities were, therefore, required to furnish particulars not only in respect of their gas, water, and electricity undertakings, but also in respect of other works involving construction, alteration, upkeep, and repair. In the returns from these authorities, tramway and light railway companies, and the National Telephone Co., the amount stated as the value of the output is a sum covering wages, cost of materials, and the establishment charges attributable to the works in question. It thus represents the cost of the works, and is not strictly comparable with the value of the output returned by building and contracting firms, which is on a profit basis.

A statement is given showing for the United Kingdom as a whole the gross output, the cost of materials used, the amount paid for work given out to other firms, the "net output," the number employed, and the net output per person employed for the industries covered by the Report.

From this statement we make the following extracts :—

| — | Gross output. Sell'g value, or value of work done. (1) | Materials used. Cost. (2) | Work given out. Am't paid to oth'r firms. (3) | Net output. Excess of Col. (1) over Cols. (2) and (3). (4) | Persons employed. (5) | Net output per person employed. (6) |
|---|---|---|---|---|---|---|
| Gas : | £ | £ | £ | £ | | £ |
| (*a*) Companies | 20,838,000 | 9,292,000 | — | 11,546,000 | 54,946 | 210 |
| (*b*) Public authorities | 10,769,000 | 5,037,000 | — | 5,732,000 | 28,585 | 201 |
| Electricity : | | | | | | |
| (*a*) Companies | 3,182,000 | 1,186,000 | — | 1,996,000 | 8,499 | 235 |
| (*b*) Public authorities | 5,721,000 | 2,149,000 | — | 3,572,000 | 14,119 | 253 |
| Post Office (Teleg. and Teleph. undertakings) ... | 2,872,639 | 2,048,557 | 169,263 | 654,819 | 10,171 | 64 |
| Nat. Tel. Co. ... | 1,503,784 | 837,191 | 156,364 | 510,229 | 7,028 | 73 |

Adding together the amounts returned to the Census Office on the schedules for the building and contracting trades, public authorities, &c., a total of £54,775,000 is obtained. A further sum of nearly £7,000,000 was included in the returns of iron, steel and engineering firms in respect of iron and steel structural work on buildings, bridges, &c.

From the details given for the various classes of work we extract the following :—

| | |
|---|---|
| Construction and repair of— | |
| Railways, light railways and tramways ... | £14,087,000 |
| Gas mains and works (other than buildings) | 1,508,000 |
| Telegraphic and telephonic lines and works ... | 4,701,000 |
| Electric lines and works ... ... ... ... | 2,913,000 |

The value of coal gas and water gas supplied by companies and public authorities was £23,157,000, coke and breeze, £4,434,000. By-products (including £1,322,000 for fixing stoves, fittings, &c.), bring the total output of gas undertakings to £31,607,000.

The total quantity of electricity generated by companies and public authorities (exclusive of that generated for their own use by industrial and commercial establishments and by railway and tramway companies) amounted to 1,430,069,000 B. of T. units. Further, 174,607,000 units were generated by railway companies, and 54,743,000 units by tramway and light railway companies for their own purposes.

Companies purchased from other companies or from local authorities 32,922,000 B. of T. units of electricity, the estimated value of which was about £230,000, and local authorities purchased from companies or from other local authorities 14,042,000 B. of T. units of electricity, the estimated value of which was about £105,000. Eliminating these duplicated amounts, the value of the electricity supplied by distributing companies and public authorities was about £8,568,000.

The quantity of electricity generated by companies other than railway, light railway and tramway companies amounted to 573,510,000 B. of T. units, and the selling value of the electricity supplied to consumers or used in the works was returned as £3,182,000.

The quantity generated by local and other public authorities amounted to 856,559,000 B. of T. units, and the selling value was returned as £5,721,000.

The works of construction, alteration and repair in connection with telegraph and telephone lines, and the manufacture and repair of telegraphic and telephonic apparatus executed by Post Office employés is summarised as follows :—

| | Construction. | Alteration or repair. | Total. |
|---|---|---|---|
| Work done on— | £ | £ | £ |
| Telegraphic lines and works... | 403,253 | 421,574 | 824,827 |
| Telephonic lines and works ... | 1,361,775 | 290,133 | 1,651,908 |
| Electric lines and works ... | 21,027 | 1,227 | 22,254 |
| Other works of construction... | 5,637 | 651 | 6,288 |
| Total value of work done ... | £1,791,692 | £713,585 | £2,505,277 |

Telegraphic and telephonic apparatus made and repaired amounted to £248,172.

The National Telephone Co. carried out works of construction to the value of £1,129,510, and of alteration and repair to the value of £374,274, a total of £1,503,784.

It is of course to be understood that the above figures for the telegraph and telephone services relate only to the work of the employés of the Post Office and National Telephone Co., and do not cover the work of contractors and supplies from manufacturers for services which will have been included in other returns.

For convenience of comparison we summarise from the tables the following particulars of the cost of materials used shown in relation to value of output (for the United Kingdom) :—

| | Cost of materials used. | Value of output. | Value of output less cost of materials used. |
|---|---|---|---|
| Gas undertakings :— | £ | £ | £ |
| Companies ... ... | 9,292,000 | 20,838,000 | 11,546,000 |
| Public authorities ... | 5,037,000 | 10,769,000 | 5,732,000 |
| Electricity undertakings :— | | | |
| Companies ... ... | 1,186,000 | 3,182,000 | 1,996,000 |
| Public authorities ... | 2,149,000 | 5,721,000 | 3,572,000 |
| Post Office telegraphs ... | 2,217,820* | 2,872,639 | 654,819 |
| National Telephone Co. | 993,555† | 1,503,784 | 510,229 |

* Includes £169,263 for work given out.
† „ £156,364 „ „

And of the persons employed :—

| | |
|---|---|
| Gas Works :— | |
| Companies ... ... ... ... | 53,679 |
| Public authorities ... ... ... | 28,209 |
| Electricity undertakings :— | |
| Companies ... ... ... ... | 8,499 |
| Public authorities ... ... ... | 14,119 |
| Post Office Telegraph s... ... ... | 10,171 |
| National Tel. Co.... ... ... ... | 7,028 |

The figures given in this and the preceding preliminary tables are subject to revision, but it is believed (says Sir G. R. Askwith) that the alterations will be of comparatively minor importance. The revised figures will be shown in the final report, which is in course of preparation.

Pending such final report, the preliminary tables are of great value in themselves, and will be of still greater value for the purpose of comparison with similar censuses to be conducted at subsequent periods. We hope then to see important changes in some of the figures we have given above.

## THE MODERN INSULATION RESISTANCE TESTING SET.

By W. A. TOPPIN.

A testing set for the measurement of insulation resistance is used to ascertain whether the wiring for motors or lights together with any apparatus connected thereto is capable of withstanding the maximum pressure to which it will be subjected when connected to the source of supply. The use of this testing instrument is often ridiculed, it being claimed that bad wiring or badly designed apparatus may easily give a high reading in megohms and yet be quite unfit to connect up to the supply mains. It is true that there is no testing set at present in use that will show the presence of two bare joints in dry wood casing, but unless a testing set will indicate the majority of defects it is a waste of time to use it. The writer is of the opinion that the present tendency in the design of this class of instrument is to render it less efficient than the apparatus manufactured several years ago.

Let us consider in what way the modern testing set differs from the old-fashioned one. The use of small batteries to obtain the required testing pressure has become obsolete, and quite rightly so. The small permanent magnet hand-driven dynamo is now almost universally used, and these used to be powerful little machines contained in a separate box from the ohmmeter. The competition between the manufacturers to produce a lighter and cheaper apparatus caused them to put the generator in the same case as the ohmmeter. They had, therefore, to reduce the weight of the generator as much as possible, and it consequently became much less powerful. It was impossible to grip the terminals of an earlier type machine owing to the severe shock obtained, but the modern machine causes no inconvenience, although it is declared to give the same pressure.

In fig. 1 are shown some results obtained from two testing sets made by the same firm, and similar results were obtained from apparatus designed recently by several other firms. The pressure was measured by means of an electrostatic voltmeter connected between the "line" and "earth" terminals, an ordinary voltmeter being out of the question owing to its possessing a closed circuit. Both generators were stated to give a pressure of 500 volts, and the number of revolutions per minute was kept as uniform as possible during the tests. For the sake of convenience there is a break in the curves at 200,000 ohms and a sudden

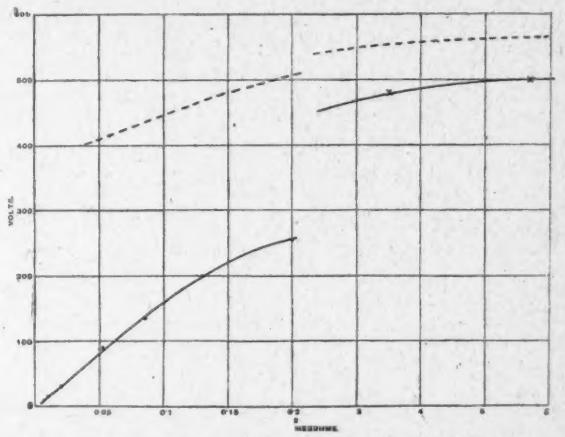


Fig. 1.—Showing Drop of Pressure at Terminals when Testing Low Resistances.

jump is made to 2 megohms. The dotted curve was obtained from a machine made about 10 years ago, in which the ohmmeter and generator were contained in two separate cases. The full line curve was obtained from a modern machine, self-contained. The contrast between the pressures obtained when testing low insulation resistances is very marked.

The attention of manufacturers, contractors and installation inspectors should therefore be drawn to the fact that although there is a greater need for a high pressure when testing doubtful wiring or plant, it is just in these cases that the modern testing set fails. When testing lighting installations with a large number of points or motors with complicated switchgear, it is not often that a result of more than 500,000 ohms is obtained, and thus the pressure at which the test is made is too low to be of much value.

## FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

Amendments.

AUSTRALIA.—A Customs order recently issued by the Australian Government states that, for the purposes of prepayment of the duty in London on advertising matter transmitted through the post to the Australian Commonwealth, the Commonwealth Minister of Trade and Customs has approved of the issue of ½d. and 1½d. duty stamps, in addition to those already available for this purpose. The following scale of charges will apply, in substitution for those previously levied :—

| | |
|---|---|
| Up to 1¾ oz. ... ... | ½d. |
| Over 1¾ oz., up to 3½ oz. | 1d. |
| „ 3½ „ „ 4½ „ | 1½d. |
| „ 4½ „ „ 5¾ „ | 2d. |
| „ 5¾ „ „ 7¼ „ | 2½d. |
| „ 7¼ „ „ 8½ „ | 3d. |
| Over 8½ oz., up to 9¾ oz. | 3½d. |
| „ 9¾ „ „ 11¼ „ | 4d. |
| „ 11¼ „ „ 12½ „ | 4½d. |
| „ 12½ „ „ 13¾ „ | 5d. |
| „ 13¾ „ „ 15¼ „ | 5½d. |
| „ 15¼ „ „ 16 „ | 6d. |

The stamps may be obtained from the office of the High Commissioner for Australia, 72, Victoria Street, London, S.W. Firms should remember that when the duty on any one mail sent by any one consignor to any one State in Australia does not exceed 1s., payment of duty is waived.

The following decisions as to the duties to be levied on certain electrical and similar goods have recently been issued by the Australian Customs Department :—

ELECTRICAL APPLIANCES, &c.—

| | |
|---|---|
| Coils, shunt, imported separately for arc lamps... ... | 20 % |
| Telephone parts imported separately, viz. : | |
| Bases, porcelain (fitted); escutcheons; hooks, receiver; knobs, ebonite; knobs, metal; springs, table telephone; vibrators ... ... ... ... ... | Free. |
| Nuts, round milled brass; pillars, bell, for wall telephones ... ... ... ... ... ... ... | 25 % |

IRONS, hot-point domestic. Parts imported separately, viz.—

| | |
|---|---|
| Cable (extra) with attachment; cable suspenders; contact tongues, brass; heating elements... ... ... | 10 % |
| Studs, with washers and nuts ... ... ... ... | 20 % |
| Switch plugs (extra), complete ... ... ... ... | Free. |

NOTE.—The rates quoted are in all cases those leviable under the British preferential tariff.

CHILE.—A Bill has recently been framed by the Finance Committee of the Chilean Chamber of Deputies which proposes to increase the Customs duties on goods imported into Chile, with the object of raising additional revenue.

The Bill provides that goods which now pay 5 per cent., 15 per cent., 25 per cent., or 35 per cent. on their official valuations, shall pay an additional 5 per cent. on those valuations; and that the specific duties levied on certain goods under Article 6 of the Tariff Law of December 23rd, 1897, shall be increased by 10 per cent. These additional duties are to remain in force for 27 months.

A duty of 5 per cent. on the official valuations is to be levied on goods—with a few exceptions—which are now duty-free under Article 7 of the Tariff Law: coal and crude petroleum (which are at present duty-free) are to pay a duty of only 2½ per cent. on their official valuations. Merchandise imported through Punta Arenas is to pay a duty of 5 per cent., except in the case of goods which, in accordance with the present Bill, remain duty-free or subject to a duty of 2½ per cent. The duties mentioned in this paragraph are to be permanent.

The stipulations respecting Customs duties contained in Government contracts are to remain in force, notwithstanding the provisions of the present measure.

It is further proposed that the foregoing tariff modifications shall take effect from October 1st next.

For information as to the duties originally levied, which will be increased if this Bill is passed, readers should refer to the ELECTRICAL REVIEW, of April 23rd, 1909.

## NEW PATENTS APPLIED FOR, 1911.

(NOT YET PUBLISHED.)

**Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.**

19,610. "Sparking plugs for internal combustion engines." W. W. LONGFORD, H. G. LONGFORD and W. A. CLARK (trading as Sphinx Manufacturing Co.). September 4th.

19,614. "Vapour electric apparatus." BRUSH ELECTRICAL ENGINEERING CO., LTD., A. E. SALISBURY and C. O. BASTIAN. September 4th.

19,615. "Apparatus for electrically-operating and controlling planing machines and the like reciprocating tools." LANCASHIRE DYNAMO AND MOTOR CO., LTD., and A. P. WOOD. September 4th.

19,616. "Apparatus for electrically-controlling planing machines and the like reciprocating tools." LANCASHIRE DYNAMO AND MOTOR CO., LTD., and A. P. WOOD. September 4th.

19,643. "Method and apparatus for forming quartz bodies fused by means of electric resistance heating." A. VOELKER and N. MEURER. September 4th. (Complete.)

19,645. "Circuit arrangements for automatic telephone systems." SIEMENS AND HALSKE AKT.-GES. (Convention date, October 12th, 1910, Germany.) September 4th. (Complete.)

19,661. "Speaking switches for automatic telephone systems." G. A. BETULANDER. (Convention date, September 5th, 1910, Sweden.) September 4th. (Complete.)

19,677. "Method of and apparatus for measuring electric energy, more particularly for the purpose of charging or sale of same." F. W. H. WHEADON. September 4th.

19,678. "Magnetic separation of ores." I. S. DALGLEISH. September 4th.

19,685. "Spark plugs." G. WRIGHT. September 4th. (Complete.)

19,741. "Self-regulating electric hot pad." S. OTTO. September 5th.

19,747. "System of electric propulsion for vehicles." J. T. LISTER. September 5th. (Complete.)

19,760. "Method of and apparatus for cooling electrical generators and motors." F. G. BAUM. (Convention date, September 7th, 1910, United States.) September 5th. (Complete.)

19,779. "Telegraphic relays." S. G. BROWN. September 5th.

19,800. "Sparking plugs of internal combustion engines." F. A. L. JOHNSON. September 6th.

19,815. "Manufacture of tungsten and incandescence bodies therefrom." E. SCHARRER and G. LUDECKE. September 6th.

19,825. "Devices for varying the length of suspension cords of electric light." E. SLADE. September 6th.

19,829. "Receiving apparatus for use in radio-telegraphy and telephony." A. DE C. BOWER. September 6th.

19,845. "Multiplex telegraphy." G. BANZATI. September 6th.

19,856. "Electric safety fuse." J. MULLER. September 6th.

19,870. "Automatic switches or cut-outs for use in charging secondary batteries from dynamo-electric machines." A. H. MIDGLEY and C. A. VANDERVELL. September 6th.

19,914. "Manufacture of tungsten and incandescence bodies therefrom." E. SCHARRER and G. LUDECKE. September 7th.

19,922. "Fuse switches." L. WEEKES. September 7th.

19,942. "Means for automatically controlling heat in electric heating apparatus." V. NIGHTINGALL. September 7th.

19,946. "Transmitting apparatus for wireless telegraphy." L. ROUZET. September 7th. Complete.)

19,962. "Method of and apparatus for electrically treating plants and the like." F. MULLER and VEIFA WERKE VEREINIGTE ELECTROTECHNISCHE INSTITUTE. (Convention date, June 20th, 1911, Germany.) September 7th. (Complete.)

19,970. "Signalling systems." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) September 7th.

20,012. "Process of superficially metallising the surface of cast-iron, wood, gypsum, paper, and other porous substances or articles for the purpose of electrically depositing metals or alloys thereof." P. MARINO. September 8th. (Complete.)

20,019. "Magneto ignition apparatus." C. & E. FEIN (Firm of). (Convention date, January 14th, 1911, Germany.) September 8th. (Complete.)

20,031. "Methods of mounting overhead wires for electric railways and the like." SIEMENS SCHUCKERTWERKE G.M.B.H. (Convention date, September 8th, 1910, Germany.) September 8th. (Complete.)

20,032. "Portable telephones and electric batteries therefor." W. K. L. DICKSON. September 8th.

20,033. "Electric furnaces." A. E. BOURCOUD. September 8th.

20,051. "Method of invoking a relay and apparatus for applications thereof." A. ORLING and ORLING'S TELEGRAPH INSTRUMENTS SYNDICATE, LTD. September 9th.

20,068. "Dynamo-electric machines." H. NEWTON. September 9th.

## PUBLISHED SPECIFICATIONS.

**Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).**

### 1910.

ELECTRIC SWITCHES. G. A. G. Davies, W. H. Kent, and D. Davies, Kent and Stewart, Ltd. 19,071. August 13th.

MEANS FOR REGULATING THE CLOSING OF ELECTRIC BELL CIRCUITS. C. Herrde. 19,199. August 16th.

IGNITION IN MULTI-CYLINDER INTERNAL-COMBUSTION ENGINES. Firm of Robert Bosch. 19,241. August 16th. (December 18th, 1909.)

SEPARATION BY MAGNETIC INFLUENCE OF ZINC, COPPER AND OTHER SULPHIDE ORES. W. M. Martin. 19,449. August 19th.

MOTOR SUPPORTS FOR ELECTRIC TRAMCAR TRUCKS. Brush Electrical Engineering Co. and S. Leech. 27,725. November 29th.

CONDENSERS FOR ELECTRICAL SYSTEMS. G. Giles. 28,179. December 3rd. (December 4th, 1909.)

SUSPENSION FOR MARINERS' COMPASSES. Kelvin & James White, Ltd., and F. W. Clark. 29,411. December 19th.

SUPPORTS FOR METALLIC FILAMENTS IN ELECTRIC INCANDESCENT LAMPS. Allgemeine Chemisches Labaratorium Oskar H. Arendt and Schlesinger. 29,505. December 19th. (December 18th, 1909.)

DYNAMO-ELECTRIC MACHINES. British Thomson-Houston Co. (General Electric Co.) 30,233. December 29th.

### 1911.

ELECTRICAL-CONTACT DEVICES. O. Engel. 320. January 5th. (Addition to No. 6,765 of 1908.)

INCANDESCENT ELECTRIC LAMPS. G. F. Richardson and R. J. Crowley. 1,907. January 25th. (April 1st, 1911.)

OVERHEAD ELECTRIC TROLLEY-WIRE CONSTRUCTION. Oesterreichische Daimler Motoren Akt.-Ges. 4,897. February 21st. (October 2nd, 1910.)

LUG-JOINTS FOR THE LIDS OF ELECTRIC ACCUMULATOR BOXES. P. J. Barnes. 6,984. March 20th.

TELEPHONE INTERCOMMUNICATION SETS. Siemens Bros. & Co. (Siemens and Halske Akt.-Ges.) 9,375. April 15th.

APPARATUS FOR GALVANISING METAL TUBES, RODS AND THE LIKE. F. Worth. 9,981. April 24th.

VOLTAIC CELLS. S. Benkö. 10,156. April 26th.

DEPOLARISERS FOR GALVANIC CELLS OR BATTERIES. Chemische Fabrik Griesheim-Elektron. 11,906. May 17th. (October 10th, 1910.)

MANUFACTURE OF ELECTRODES FOR ELECTRIC ARC LAMPS. A. Blondel. 12,094. May 18th. (Addition to No. 6,060 of 1903.)

**Saturn's Rings, and Sunspots.**—The well-known Norwegian, Prof. Birkeland, in a lecture at Christiania, has launched a very interesting hypothesis regarding the nature of the ring system of the planet Saturn. For a long time astronomers have considered the rings to consist of an immense mass of small particles encircling the planet. Prof. Birkeland, on the contrary, supposes the rings to be an electrical phenomenon produced by the radiation of luminous matter from the planet, and that the rings—thanks to the continuous radiation—are being constantly renewed. By experiments during the lecture he demonstrated that Saturn's rings may be imitated on a small scale. He points out that there is good reason to believe that such a "radiating ring" will show effects of light and shadow like those observed, and that by means of the hypothesis of radiation, it will be possible to find a satisfactory explanation for all the peculiarities of the rings. As to the sun and its activity, Mr. Birkeland sets up new theories; he opines that the sunspots are huge electric arcs penetrating the photosphere, with negative poles on the outer surface. The explanation which Prof. Birkeland has given with reference to the nature of Saturn's rings is, in his opinion, also applicable to the Zodiacal light. This phenomenon, he says, shows that the sun is encircled with a ring similar to that of Saturn, but of much greater dimensions.

**Accident.**—William Phin, 24, an electrical engineer, of Paisley, sustained serious injuries through a fall while at work in Messrs. Fullerton, Hodgart & Barclay's engineering works. Phin had been working on a 12-ft. ladder putting up wires when, an insulator giving way, he lost his balance and fell to the ground. He was removed to the infirmary suffering from injuries to the head and body.